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# Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

*Editorial Office:* 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXII NO. 7

## TABLE OF CONTENTS, AUGUST-SEPTEMBER 1948

Pilots for Plowmen 3
*Good for Farmers, Says Jeff*

Growing Alfalfa in North Carolina 6
*W. W. Woodhouse, Jr. Suggests Methods*

Soil Analysis—Western Soils 9
*W. T. McGeorge Gives Procedures and Findings*

Everyone Wins in Pasture Contest 15
*Jack Spaven Tells Why*

How Much Lime Should We Use? 17
*Asks V. A. Tiedjens*

A Soil Management Program for Penn Tobacco Farmers 21
*Set Forth by Orman E. Street and Clifford O. Jensen*

Soil Conservation Raises Midwest Crop Potentials 25
*L. R. Combs Describes How*

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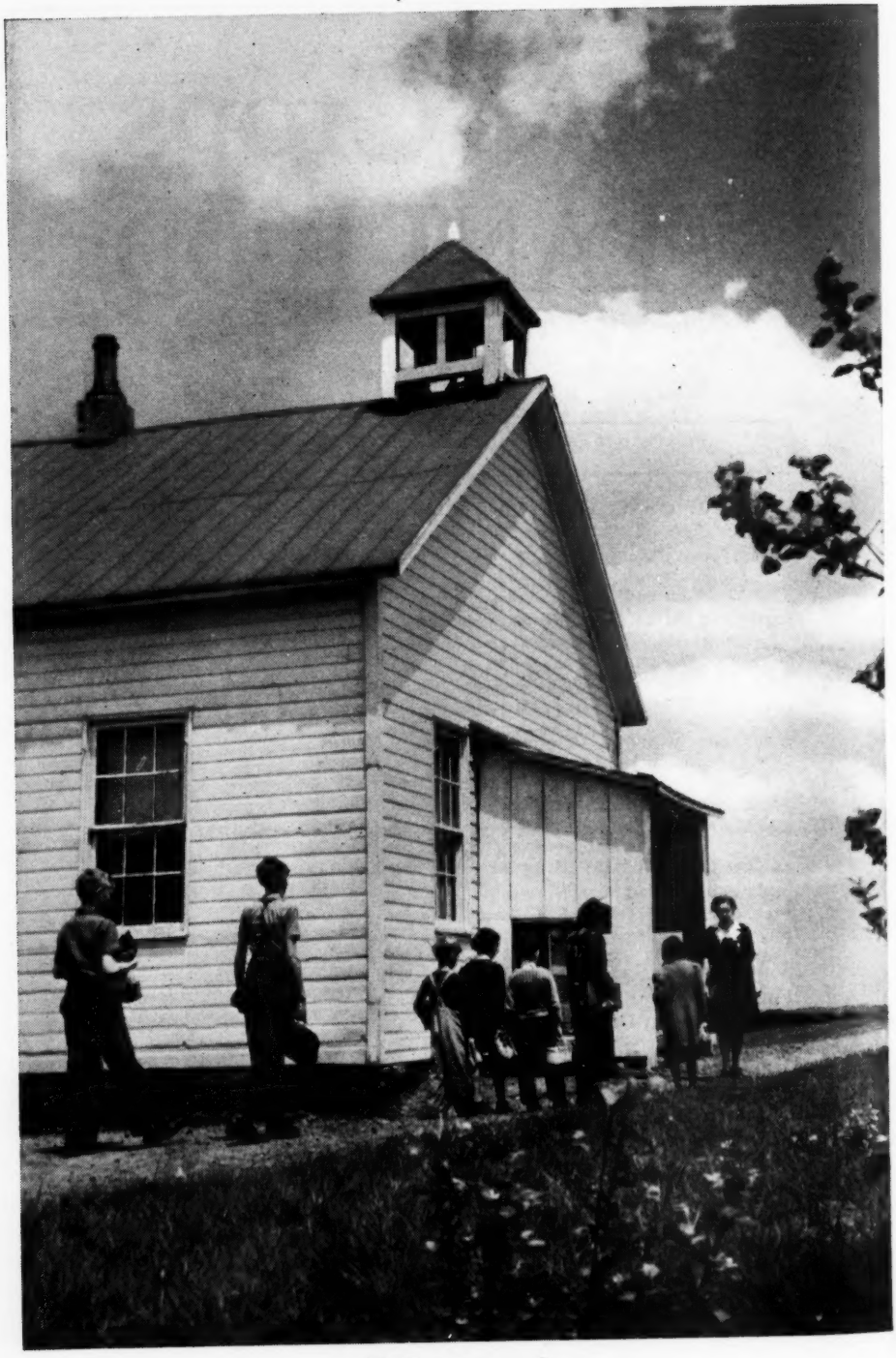

**Reluctance!**

Better Crops with PLANT FOOD

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VOL. XXXII WASHINGTON, D. C., AUGUST-SEPTEMBER 1948 No. 7

*Extension Service provides . . .*

# Pilots for Plowmen

Jeff McDermid

WHEN an inquiring Associated Press reporter last week sought some causes for the unprecedented flow of plenty from the crop cornucopia of 1948, some of us "wiseacres" listed for him all the generally accepted reasons why the farmers of this country are so prolific in production. These, of course, are standard answers which we recite glibly. They include improved seed from plant breeding, soil fertility and conservation practices involving greater fertilizer usage applied more intelligently, multiplied man-power through power mechanics, conquest of soil and plant diseases and insect ravages, hard work and long hours, good planning, and finally, highly favorable weather.

After he was gone with his notebook stuffed and his mind in a whirl about big corn crops and support prices and visions of 25-cent sirloin 18 months ahead, we paused to consider one point we forgot to mention. That point is that aside from the weather and farm industry, every one of the other contributing factors to bumper crops in recent years might have remained locked in libraries and laboratories without the indefatigable labor of the Cooperative Extension Service and the associated local and regional farm leaders.

For my own part, I have not only lived through the cycle of kerosene lamps and buggy riding to electric transmission and tractor farming, but I have gradually observed a shift from lonely guesswork on isolated farms to a vast educational system reaching well-knit rural communities via radio, newspaper, farm journal, and discussion

meetings. In my youth the plowman had no pilot.

As for weather, we had the kind that was hot enough to bring out hordes of grasshoppers and some that was damp enough to encourage fungi and rust. We had admirable, balanced weather meantime which gave the weeds a dandy start ahead of the weak seed and thin topsoil; and we enjoyed pelting rains after drought only to see our gullies washed into gaping holes and wasteful landslides. Oh, yes, friends, we were well supplied with weather in the days of my youth, and by lucky chance and terrific toll in human energy we amassed pioneer wealth from virgin earth—while it lasted.

HERE we might stop a minute to remember that these eras of empirical farming and risk-taking against big odds were changed to a modern system of secure knowledge and relative confidence mostly by the democratic process—education which sold itself and had no decrees or dictators to force it upon us. By contrast, just peek at the following sample of another approach to agricultural know-how. It is copied from the July 1948 edition of the outline of procedure in the Hungarian Three Years' Plan for Agriculture, page 8:

"Local agricultural authorities have been established recently by a governmental decree. They are called 'farmer secretaries.' Their employment, tasks, and activities are regulated now by Decree No. 100.500, of the Minister of Agriculture. They are used to raise the quality and quantity of agricultural production, to promote the farming of the new farmers, and to provide for the responsibilities of local administration and technicians regarding the carrying out of the Three Years' Plan in Hungarian agriculture. Farmer secretaries must be employed in all large villages and agricultural towns and in all districts where there are small communes only."

Moreover, within this broad decree are several minor ones that regulate and impose obligations and penalties through which a sort of compulsory regimentation becomes the keystone of the whole framework of this new extension system in Hungary. It is idle to stop and think over the traditional differences between these peasants abroad and our independent farmers in regard to such iron-clad movements. The main point herein is to trace the way our own extension education took root, by convincing example rather than compulsion.

How it originally began is an old, oft-told story. Beginning in 1906 the Federal Department of Agriculture, under the leadership of Dr. Seaman A. Knapp, started the employment in the South of Federal agents to work in a single county the year around and help the farmers with their problems, mostly growing cotton in stiff competition with the boll-weevil. Every time we pass through the eastern ramp connecting the USDA's main building with the vast network of offices in the South building, the name of Knapp given to this archway recalls the cradle of county agent activity.

THUS the beginning of extension was in a small, experimental way, growing slowly but surely through the intervening years. The Smith-Lever Act of 1914 laid the basic law supporting it, yet only $10,000 of Federal funds was appropriated at that time to each of the cooperating States. Inside of one year this method was slightly changed to a rural population ratio of distribution, obliging each cooperating State to plank down matching sums above and beyond the initial free fund of $10,000 furnished by Uncle Sam.

Hence we had a purely local option at work, without force or great monetary bribery. Any State could do as it wished—take it or leave it, but most of them saw the light and seized the

chance to keep step in agricultural advancement.

I recall the first county agents appointed in my home State. The Dean of our State College called them "county agricultural representatives," meaning that they represented the College and its link with USDA on the local scale. We had four of these men. The first one went to work in a northern cut-over county, making seed potato improvement and land clearing his main

theme. Later he was named boss of farmers' institutes and is now retired and busy with his roses and his grandchildren.

The other three were also in counties of a raw state insofar as farming was concerned. One reason for thus posting pioneer extension agents in newly settled counties is self-evident. In our newer pioneer communities folks get together for mutual aid and comfort more than in the rather smug districts of ancient tradition. Beginners amid the stumps and short growing seasons had greater reason to rely upon outside educational aid and comfort. So that's the way it started up yonder, and then spread out southward and circled the entire State inside of 15 years.

No doubt the advice and suggestions which these four young college-trained men made to hardy settlers had some flaws, and part of it is moss-grown and discarded stuff today. Yet it had great social values and organization purposes aside from the actual farm facts presented. It made for better living and friendlier contacts. Two of these men soon left the service for farms of their own and one is sleeping in the soil he helped to improve.

If you should mention the rag-doll seed tester, the wire hook corn dryer, the litmus paper soil acidity test, use of formaldehyde for seed treatment and the plowing of a straight furrow with horses regardless of the lay of the land, such teachings that occupied the long days of those first county agents would be laughed off the scene today. Like the ringing slogan of the 4-H leaders, they and their farmer cohorts have kept in touch with progress ever since to "make the best better." Those things are all useful yet in their way, just like the horse and the walking plow. But we have outgrown them.

To be sure, we had nice little rows and debates concerning the value and objectives of our new county agent system. Many a time I have attended farm meetings and listened to irreconcilables divest themselves of honest anti-opinions. Some averred it was the long arm of Wall Street reaching out to control farmers and produce big and cheap food crops. Others merely scoffed at book learning and the advice from stuffy office professors. They also despised agricultural statistics, declaring that such figures only guessed at the truth and were used to depress farm prices by reporting full bins. Once in a blue moon you hear the same attack made on crop estimates today, but transportation and communication being what they are now the old imaginary visions of a faked crop report won't stand up.

BEAR in mind, however, that this very antagonism and freedom of opinion were the salt that lent savor to the growth of the idea. Had we stifled them by decree or frowned on open expression against being "the one by whom the new is tried" our education afield would have suffered strangulation. Americans won't accept anything

(*Turn to page* 49)

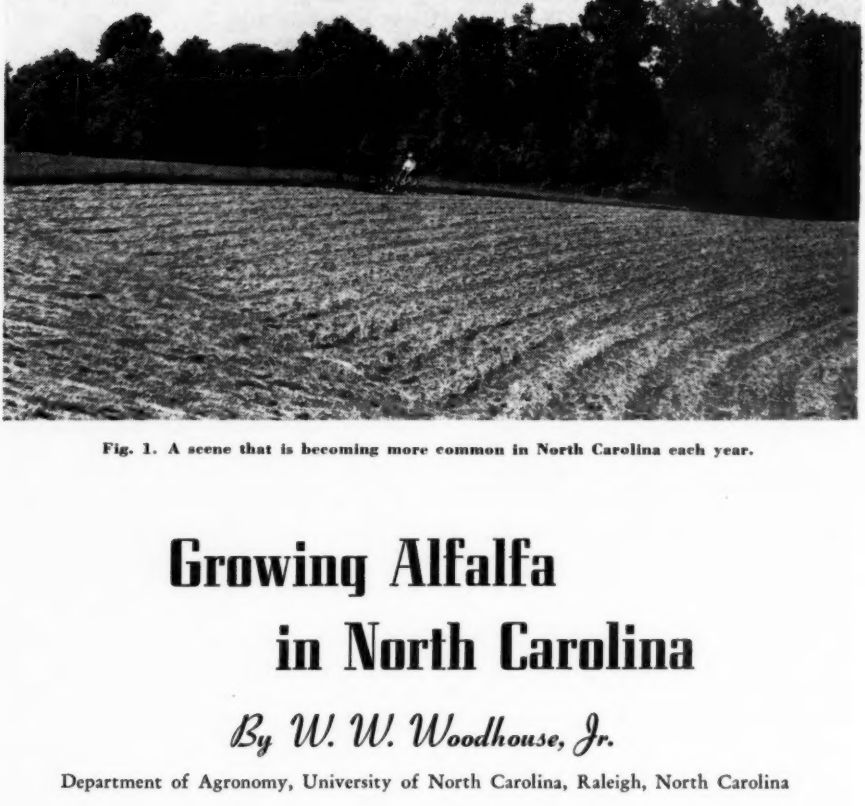


**Fig. 1. A scene that is becoming more common in North Carolina each year.**

# Growing Alfalfa in North Carolina

*By W. W. Woodhouse, Jr.*

Department of Agronomy, University of North Carolina, Raleigh, North Carolina

MANY a North Carolina farmer has established his first stand of alfalfa sometime during the last three years. In fact, the acreage of this crop in the State has been expanding for the last several seasons just about as rapidly as seed and fertilizer supplies would permit. This increased use of alfalfa on North Carolina farms is due largely to the fact that we have found that it can be grown successfully and economically. We have wanted it for a long time but didn't know how to produce it.

There are a number of improved practices that have enabled us to raise our batting average with the "king of hay crops." The most important of these is better fertilization. However, they are all essential, so in telling how it's done it is best to start at the beginning and follow the job straight through.

## Selecting the Soil

Alfalfa is a deep-rooted plant and must have good drainage. Naturally, it grows best on the more fertile soils, but it is being grown successfully on practically all the well-drained soil types in the State. If the land is not too fertile the difference just has to be made up with fertilizer.

Excessively weedy fields should be cleaned up before trying to get them into alfalfa. Weeds at the seedling

stage cause a lot of trouble. Since alfalfa is a heavy hay producer, plant it as close to the hay mow as practical.

### Seedbed and Seeding

Discing down some cover crop such as lespedeza helps in establishing alfalfa by reducing erosion and preventing baking of clay soils. It is usually best to disc rather than plow, leaving part of the cover on the surface as a mulch. A well-pulverized, shallow, firm seedbed is needed for alfalfa. Cut in the cover crop early so as to allow time for a good rain between this operation and the final harrowing and seeding.

Alfalfa may be seeded satisfactorily with a knapsack seeder, grain drill, or cultipacker seeder (or even by hand if it is done carefully). Covering can be done with a brush, weeder, harrow, or cultipacker. The cultipacker with seeding attachment does it all in one operation and seems to do the best job. Try to get the seed distributed uniformly and covered not over one-half inch deep.

Use 20 to 25 pounds of adapted seed per acre. If more seed appear to be needed you're probably trying to substitute seed for fertilizer, seedbed preparation, proper seeding date, or some other essential part of the process. Seed are an expensive and unsatisfactory substitute in any case. As you get more experience and acquire better equipment you will be able to reduce the seeding rate.

Kansas and Oklahoma common are the best adapted varieties of those available. The more Northern types are less productive, the more Southern ones may winter-kill. There are a number of new strains such as Atlantic that appear promising for this area. However, seed of these are not yet available.

One small but vital step that should never be overlooked is that of inoculation. Always inoculate, even on soils that have grown alfalfa before. Keep inoculated seed out of the sunlight and cover as rapidly after seeding as possible. Watch the new seeding carefully. Occasionally inoculation may be poor or spotty. If noticed in time, this may be corrected by broadcasting a mixture of culture and cottonseed meal over the field on a rainy day.

The best seeding dates in North Carolina are from August 1 to 15 in the higher mountains to September 15 to 30 in the Coastal Plain. These late summer seedings are usually best since they allow the plants to become established during cooler weather and with less weed competition than spring seedings. Consequently, they usually produce about a full crop of hay the first season. Spring seedings are satisfactory at times but are less dependable and usually result in a short crop the first year. They may be the most desirable in cases where winter weeds are the major problem.

### Fertilization

Now we come to the all-important step in growing alfalfa. This plant produces high yields of forage rich in protein and minerals. Consequently adequate supplies of phosphate, potash, and lime are a "must."

In preparing for alfalfa on our acid soils adequate lime is the first essential. The safest bet is to lime according to soil tests. Most unlimed soils will require from one to three tons of ground limestone. By all means get this on prior to discing down the cover crop so that this operation will work the lime into the soil. Much of the advantage of alfalfa's deep root system may be lost by not having the lime with the roots. The importance of this may be seen in the following data of the North Carolina Experiment Station:

| *Method of Application of Ground Limestone* | *Alfalfa Hay—3 yr. Av. Pounds per Acre* |
|---|---|
| Broadcast at seeding ..... | 3,665 |
| Mixed with soil prior to seeding | 5,414 |

Be sure to put the right amount of lime on the field but also see that it is

**Fig. 2. Wake County Agent John Reitzel and Extension Specialist Sam Dobson with alfalfa growers, present or future.**

spread over the entire field. Too much on some spots and none on others may average out the proper amount for the field as a whole, but result in poor alfalfa.

Most people know that alfalfa is a "lime-loving" plant. Recognition of the fact that it also has a high requirement for phosphate, potash, and boron has probably been the most important single factor enabling North Carolina to expand production of this crop. Under average conditions we suggest at seeding an application of 800 to 1,000 pounds of 2-12-12 plus 20 to 35 pounds of borax. A very high proportion of the alfalfa seeded in the State has received this fertilization with good results. However, where soils are known to contain good potash supplies the following suggestion seems to be an improvement. Work in 1,000 pounds of superphosphate and then use 500 pounds of 2-12-12 at seeding.

The reason behind this alternative suggestion is this: Alfalfa seems to be quite responsive to heavy applications of phosphate, made prior to seeding, with the effect carrying over for several years. For example, phosphate applications have produced 30 to 40 per cent increases in yield the third year after application. On the other hand, excessive potash applications result in excessive potash uptake on the part of alfalfa without an increase in yield. The potash content of a normal alfalfa plant can be doubled just by piling on more potash. This is a wasteful use of this fertilizer and means that it isn't feasible to apply several years' supply at once. That makes it all the more important to keep up the supply of this element by annual topdressings. It usually is not necessary to topdress the first year after seeding, but every year thereafter apply 400 to 600 pounds of 0-9-27 (or 0-12-12) plus borax. Right after the first cutting seems to be the most satisfactory time to put it on.

Boron is quite generally needed for alfalfa on North Carolina soils so don't be deceived by the small amount required. Be sure it goes on at seeding, and it is good insurance to reapply it in each annual topdressing.

### Management

Alfalfa is grown primarily as a hay crop in this State. A few farmers are grazing it to advantage. In most cases

(*Turn to page* 41)

# Soil Analysis—Western Soils

*By W. T. McGeorge*

Agricultural Chemist, Experiment Station, Tucson, Arizona

SOIL analysis as a means of measuring soil fertility and for estimating the fertilizer requirement of a soil or the crop that is to be grown thereon has literally been "kicked around" by soil technologists, agronomists, and horticulturists ever since Liebig first advanced his mineral theory of plant nutrition. Through it all, however, the farmer has continued to come back more and more frequently to experiment stations for soil analysis. To him it appears a logical guide to follow in planning his fertilizer program, and so he keeps putting on the pressure.

When Liebig first advanced his mineral theory of plant nutrition, more than 100 years ago, the path ahead for the soil chemist appeared to be rosy indeed—a simple matter of making a chemical analysis of the plant to determine its mineral content and of the soil to learn its inorganic composition. This simple procedure was actually followed for more than 50 years with only an occasional challenge from advocates of weak organic and inorganic acid solvents as soil scientists came gradually to recognize that the reserve plant-food elements in soils exist in different degrees of solubility and availability.

The major challenge came from Whitney and Cameron in 1903 when they published their famous "Bureau of Soils Bulletin 22, The Chemistry of the Soil as Related to Crop Production." This bulletin challenged soil chemists to measure the increase in mineral plant-food content of the soil which is represented by a fertilizer application. It was not possible to meet this challenge with the then existing methods of analysis.

For example, a 30-bushel wheat crop removes approximately 50 pounds of nitrogen, 20 pounds of phosphate ($P_2O_5$), and 30 pounds of potash ($K_2O$) per acre and the soil should receive approximately these amounts in a fertilizer application. On an acre foot basis, four million pounds per acre foot, this represents only .00125 per cent N, .0005 per cent $P_2O_5$, and .00075 per cent $K_2O$. Obviously such small amounts in the soil could not be measured easily and thus soil analysis received quite a setback.

As our knowledge of plant nutrition advanced and micro or equally delicate methods of analysis were developed, soil analysis began to come back stronger than before and it is now in great favor and wide use at a number of experiment stations and commercial laboratories. This is largely due to the fact that the modern development of soil analysis has proceeded along lines which emphasize and point toward more accurate interpretations. The analysis, regardless of method, is a simple operation and can be conducted by an analyst with only limited training. The problem is largely one of interpretation and this can only be made by one with a background of experience.

A failure to appreciate the value of soil analysis is largely due to other things besides experience with soils and crops, although this is the primary essential for the interpretation. Available plant food in soils is only one of many

growth-promoting factors, and soil analysis must be considered collectively with all others. Different crops have different feeding habits and plant-food requirements. For example, a crop of celery requires about 4.5 times as much N - P - K as a crop of wheat. There are equally great differences in plant-food ratios. Celery requires 1.6 times as much nitrogen, 3.25 times as much $P_2O_5$, and 7.8 times as much potash ($K_2O$) as wheat. In addition one must consider the physical and biological growth-promoting and growth-limiting factors. Even seasonal variations in climate greatly affect fertilizer response.

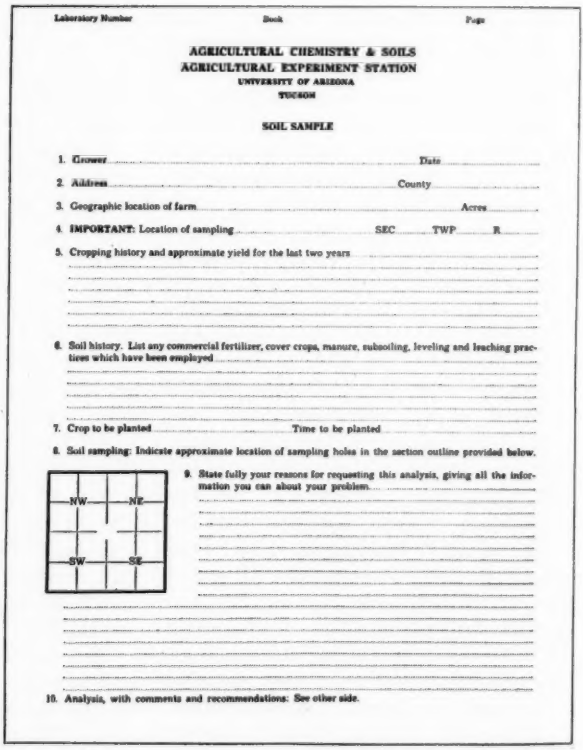
## What Is Soil Analysis?

Soil analysis is an attempt on the part of the soil technologist to simulate, by means of solvents, the ability of plant roots to extract and utilize plant-food elements present in the soil. It must be admitted at the outset that soil analysis is an empirical procedure; that is, it is only a guide and in the absence of supporting information and a knowledge and experience on which to base an interpretation its value is extremely limited. In an attempt to overcome the objections to this empirical nature of chemical methods, plant tests have been proposed—notably the Neubauer seedling test. Research at the Arizona Experiment Station has shown that the Neubauer method is just as empirical as a chemical analysis. Neubauer values were shown to vary significantly with variation in the ratio of number of seedlings to weight of soil; that is, variation from the standard 100 seedlings per 100 grams of soil as recommended by Neubauer. It is questionable whether seedling tests are an improvement over chemical extracting agents.

## Solvents

A major improvement in soil analysis has been in solvents and methods of extraction. To appreciate this one needs only to compare modern extracting solvents with the strong hydrochloric acid which was the standard for so many years. But even with the best of solvents now in wide use for soil analysis few if any have universal application to all soil types, particularly with respect to available phosphate.

A large percentage of the soils in the Western States are highly calcareous. In Arizona practically all the soils of the irrigated valleys are alkaline-calcar-



Laboratory Number Book Page

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SOIL SAMPLE

1. Grower ..... Date .....
2. Address ..... County .....
3. Geographic location of farm ..... Acres .....
4. IMPORTANT: Location of sampling ..... SEC ..... TWP ..... R .....
5. Cropping history and approximate yield for the last two years .....
6. Soil history. List any commercial fertilizer, cover crops, manure, subsoiling, leveling and leaching practices which have been employed .....
7. Crop to be planted ..... Time to be planted .....
8. Soil sampling: Indicate approximate location of sampling holes in the section outline provided below.

NW NE SW SE

9. State fully your reasons for requesting this analysis, giving all the information you can about your problem. .....
10. Analysis, with comments and recommendations: See other side.

**Fig. 1. Form on which information is given concerning soil samples which are submitted for analysis.**

**Fig. 2. Sparklet syphon used for field test for available phosphate in calcareous soils. Carbon dioxide cartridge at left and attachment for charging at right.**

eous types. Such soils are definitely problem soils with respect to phosphate fertilization. The study of this type of soil has been a major project at the Arizona Experiment Station for many years. The study of analytical methods has shown that the acetate buffers and the dilute organic and inorganic acid solvents are of little or no value. Both good and poor soils (good and poor with respect to phosphate response) show strong positive tests for available phosphate with these solvents. Carbonic acid was selected, after much study, as the most suitable extracting solvent for giving significant data for calcareous soils.

Phosphate availability and uptake in alkaline-calcareous soils are greatly influenced by soil reaction (pH). Within the pH range 8.0 to 8.5, solubility in water is at a minimum. Solubility increases with increase in pH due to the solubility in solutions where free hydroxyl ions are present. Practically all calcareous soils containing black alkali are high in water-soluble phosphate. Solubility increases with decrease in pH below pH 8.0, because of the solvent effect of carbon dioxide, and becomes appreciable at pH 6.0 to 6.5. It is clear from this that in order to show differences between high and low phosphate availability in calcareous soils the solvent must be weakly acid and weakly buffered. Carbonic acid best fulfills this requirement. It has been used in routine soil analysis at the Arizona Experiment Station for 15 years and has come to be recognized as an excellent guide. Nitrate, phosphate, and potash are determined in the carbonic acid soil-extract. The supporting information required on all soil samples submitted for analysis is shown in the form given as these data are essential in interpreting the analysis.

### Phosphate

Calcareous Western soils contain 8,000 to 15,000 pounds $P_2O_5$ per acre foot of soil. The soils are typical semi-arid types in that they contain very little organic matter. This is one reason why, even though they possess a high reserve of phosphate, it is very low in availability in many cases. The excess of calcium carbonate in the soil is the major reason for the low availability. On the basis of fertilizer tests with alfalfa and truck crops, the following values are used for interpreting phosphate analyses.

0—5 parts per million $P_2O_5$ shows the soil is deficient in available phosphate. Such soils will respond to phosphate fertilization for most crops.

5—10 parts per million $P_2O_5$ indicates that the soil is probably deficient and phosphate fertilization is advisable for most crops. Above 10 parts per million $P_2O_5$ the soil is probably not deficient for any except intensively grown crops such as vegetables.

Parts per million multiplied by four gives pounds per acre foot of soil. On comparing these values with crop figures, such as those given on a chart distributed by the American Potash Institute showing pounds of phosphate removed from the soil by various crops, and allowing for the recognized efficiency of a phosphate application, the analysis is an excellent guide to fertilization.

### Nitrogen

Semi-arid Western soils are notably deficient in nitrogen because there was so little plant cover on them in their virgin state and therefore little plant debris to build up a supply of organic matter in the soil. The only nitrogen determination that seems advisable in these soils is nitrate. Strange to say, nitrate exists in appreciable amounts both in the soils and in the underground water that is pumped for irrigation. If the nitrate test shows 10 parts per million, this is considered a good supply of nitrate nitrogen. This is equivalent to 40 pounds of nitrogen per acre foot of soil and is further equivalent to an application of 250 pounds of sodium nitrate. The nitrate interpretation needs different supporting information from phosphate and potash in order to interpret the analysis. Nitrate moves freely with the soil moisture and for this reason it is essential to know the date of irrigation with respect to the date the soil sample was taken. It preferably should be taken just before an irrigation. The "Plant-Food Utilization Chart" is useful in making a recommendation from the analysis.

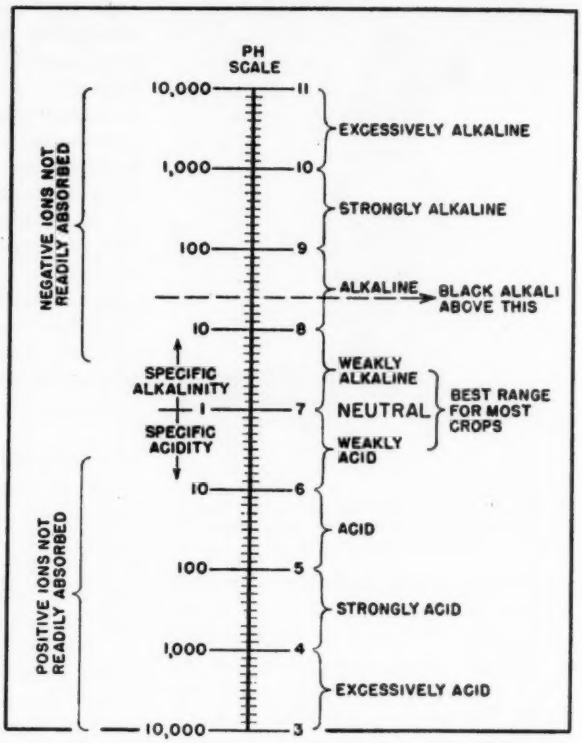


**Fig. 3. pH scale used for interpretation of pH determination in soils.**

### Potash

The alkaline-calcareous soils of the West, unlike many of the other soil types, seem to be well supplied with available potash. In Arizona there has been some evidence of response in quality or grade but none, as yet, in increased yields. For this reason we have had no soils on which to study the application of chemical analysis to the determination of available potash in calcareous soils. Some comparisons have been made between Neubauer values and the chemical determination of carbonic acid soluble potash and good correlations have been obtained.

### Quick Field Tests

Field kits with which qualitative and semi-quantitative tests for available plant food on soils can be made in the field are becoming increasingly popular among county agricultural agents and other field workers. Their use on Western soils has been limited because none of the proposed tests for phosphate was suited to highly calcareous soils. The carbonic acid test which we have found so useful has been limited to laboratory use because of the need for a supply of liquid carbon dioxide. This limitation no longer exists. A supply of carbonic acid can be carried in a "sparklet" syphon of the type shown in Figure 2. This syphon holds

one quart of water and is equipped with an attachment by which it can be easily charged from small cartridges of liquid carbon dioxide. Using five grams of soil and shaking for one minute with 100 cc. of charged water from the syphon, the filtrate from this can be tested with the reagents that are a regular part of most field kits. In fact the proportion of soil to carbonic acid solution that is recommended for the test permits the use of the phosphate color chart which is a part of the La-Motte soil test kit.

### Other Routine Soil Tests

For Western soils there are two growth-limiting factors that must always be considered in analyzing and interpreting soil analysis. These are salinity and pH, or, as more often called, white alkali and black alkali.

*pH.* A high pH value is a major growth-limiting factor. The determination of the pH value of a soil continued to be a problem until there were developed glass electrodes of such strength that they could be inserted into soils at field moisture content with a minimum of breakage. Because of the hydrolysis of potentially alkaline compounds in soils, on dilution with water, the pH value must be made at a moisture content which is closely that of the soil in the field. Otherwise the value does not represent the true pH value. All pH values of alkali soils should be made on a soil paste. The manner in which soil pH values are interpreted is illustrated by Figure 3.

**Fig. 4. Showing a unique method for demonstrating a plant-food deficiency in soils. Two tomato plants are grown in deficient soil to height of about six inches, then one plant is bent over into fertilized soil and covered so that roots will develop from stem. Illustration is a drawing made of plants growing in phosphate-deficient soil unfertilized and fertilized with phosphate.**

*Salinity.* Salinity, often referred to in soil analysis reports as total soluble salt or white alkali, is a real puzzler in the routine analysis of Western soils; yet it has generally been considered the simplest determination. In the first place it represents a collective value largely composed of the sulphates, chlorides, and bicarbonates of calcium, magnesium, and sodium. In order to reduce the time required for a salinity determination, electrical conductivity methods are usually employed. It has been the general practice in the past to determine the soluble salt in a 1:5 water extract of a soil and convert this to parts per million soil or pounds per acre foot of soil. This is the method now in use at the Arizona Experiment Station.

In the offing there are numerous changes and modifications in methods of determining soil salinity, for expressing soil salinity values, and for their interpretation. The need for such changes is imperative particularly in the development of methods for the routine laboratory examination of Western saline soils. Soil salinity is a major growth-limiting factor. It affects both moisture and nutritional relations between the plant, the soil solution, and the soil. It also influences such soil properties as pH, soil structure, water penetration, and base exchange reactions between the clay fraction and the soil solution. Pending a standardization of methods and interpretation of methods the extraction of one part soil with five parts water is still in common use.

For interpreting a salinity analysis, supporting information is essential particularly with respect to the soil horizon

which the sample represents. Salts may be concentrated at one or more soil levels and thus may confuse the analysis unless the analyst has a knowledge of how the sample was taken. The following limits of tolerance are in use at the Arizona Experiment Station.

| | | | | |
|---|---|---|---|---|
| 0 | to | 700 | parts per million | negligible |
| 700 | to | 1,500 | parts per million | weak alkalinity |
| 1,500 | to | 3,000 | parts per million | medium strong alkalinity |
| 3,000 | to | 8,000 | parts per million | strong alkalinity |
| 8,000 | to | 15,000 | parts per million | very strong alkalinity |
| above | | 15,000 | parts per million | excessive alkalinity |

These limits must be used with some elasticity, for less salinity can be tolerated by crops in sandy soils than in clay soils and because the tolerance range of different crops varies widely. Experience is highly essential for interpreting a salinity determination.

### Moisture Equivalent

Some years ago one of our county agricultural agents suggested that a moisture equivalent determination be included in our routine laboratory analysis of soils. Moisture is, of course, the greatest growth-limiting factor in irrigated agriculture in semi-arid regions. Naturally moisture values are important in relation to yields of crops on these soils and to response to fertilization. Strangely the moisture content of a soil does not tell how wet it is. A sand containing 20 per cent water is a saturated soil, a loam containing 20 per cent water is only moist, and a clay soil is dry at this moisture content. While the moisture equivalent is an arbitrary value, it represents a moisture content at which all soils are equally wet although they contain different percentages of water. Briefly it represents the amount of water a soil will hold against a centrifugal force 1,000 times gravity. The determination is made in a centrifuge designed specially for this determination and can be made easily and rapidly.

The two soil fractions which possess the greatest water-holding capacity are clay and organic matter. Semi-arid soils contain so little organic matter that we usually disregard this fraction in considering moisture relations in these soils. In a way this is an advantage as it simplifies the interpretation of the moisture equivalent. The moisture equivalent is closely the optimum content of water for crop growth. It is a value from which other soil constants, notably the wilting point and the water-holding capacity of the soil, can be calculated at a useful approximation. It is also an approximate

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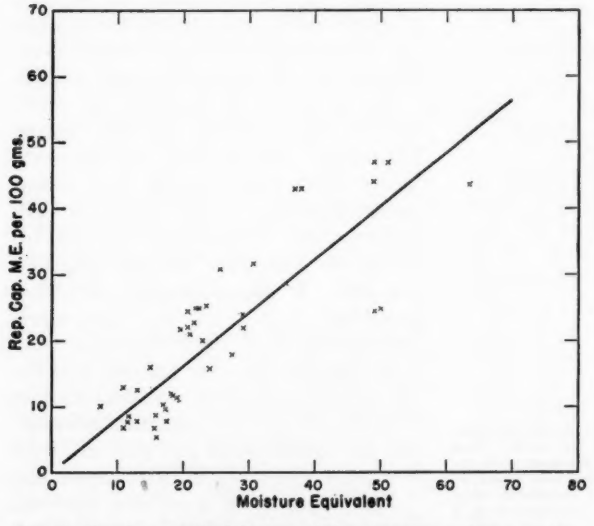


**Fig. 5. Showing practical linear relation between moisture equivalent and replacement capacity of soil.**

C. Leland Slattern (second from left), Warner, N. H., winner of the 1947 New Hampshire Green Pastures Contest, hopes to repeat again this year, this time as a New England Green Pastures Champion. Shown above (left to right) are: Ford S. Prince, Agronomist, Univ. of N. H.; Mr. Slattern; Paul R. Miller, Assoc. Dean, College of Agr., Univ. of Vt.; and Ralph Donaldson, Agronomist, Univ. of Mass.

# Everyone Wins in Pasture Contest

*By Jack Spaven*

Extension Editor, University of Vermont, Burlington, Vermont

DAIRYMEN in New England are this year doing their best to reverse the old axiom which holds that grass always looks greener on the other side of the fence. Nearly 2,000 Yankee farmers are going all out to prove that the best and greenest grass is grown on their own acres and not on their neighbors' pastures.

This friendly rivalry for better pastures started as the result of the New England Green Pastures Contest, which is being held throughout the six-state area this year.

What puts this contest in a class by itself is the fact that every man who enters is bound to be a winner. Although every farmer will not be able to take home part of the $2,000 offered as sectional prizes, he will win and win plenty right on his home farm. As Robert H. Boothby, past president of the Maine Livestock Breeders' Association points out, "The best thing that farmers will get out of this contest will be the improved pastures they will produce. That is one of the best prizes that any of us can win."

New Englanders, whose great dairy industry is based on good pastures and haylands, know the value of grassland improvement and were quick to take

advantage of a contest that would aid them in producing better feed for their cows. Over 600 Vermont dairymen signed up for the contest. Five hundred and thirty-six Massachusetts farmers entered; New Hampshire has 227; Maine, 225; Connecticut, 205; and Rhode Island has 86 in the contest. These dairymen will be visited by county pasture judges who will rate their pasture programs on seasonal grazing, management, and pasture for young stock. Three state winners will be selected from each of the six states. These men will compete for sectional prizes amounting to $2,000.

In addition to better pastures and big cash awards, there are plenty of other reasons why this contest should be a success in New England. J. Ralph Graham, Boscowen, New Hampshire, chairman of the New England contest committee, points out that "New Hampshire dairymen who raise better green pastures for their dairy cattle could increase their income by more than $6,000,000 in one year. Multiply that figure by six and you can realize the potential power of this contest on the New England dairy industry."

The Green Pastures Contest grew out of a bet. Governor Charles M. Dale of New Hampshire bet the other five New England governors that their states could not produce a pasture program as good as New Hampshire's best. The Governor whose state wins the contest will be given "the best hat money can buy."

Agronomists and county agents in all states have been busy this season arranging special meetings, tours, and featured speakers to show their farmers how they can make better and greener pastures.

A similar contest for New Hampshire farmers last year gave many tips on how to get better pastures. Ford Prince, agronomist at the University of New Hampshire, points out that the 1947 contest in that state showed that men with excellent pastures were top-dressing their haylands and pastures with fertilizer every year. That was one big reason why such pastures rated high on the score card.

Fertilizer is one of the best buys that a farmer can make, Lester H. Smith, agronomist at the University of Vermont, points out to his Green Mountain State farmers. A ton of fertilizer will produce four tons of milk and that is a mighty good investment for any dairyman these days, says Smith.

The efficiency of a dairy farmer depends to a large degree on the cost of the raw materials he feeds his animals. According to Ralph Donaldson, Agronomist at the University of Massachusetts, an acre of good pasture would at present prices yield $150 worth of feed. Put another way, 100 pounds of digestible feed from pasture costs $1.26 contrasted with a cost of $4.23 for a comparable amount of concentrate grain feed. A poor pasture will yield about 500 pounds of such feed, while well-managed pastures would produce 1,500 pounds or more.

New England farmers have taken advice such as this to heart, and pasture improvement is a topic of top interest at any gathering of farmers. Moreover, they are doing something about it. County agents report that record amounts of fertilizer are being applied to pastures this year, more farmers are clipping pastures, and pasture rotation is increasing.

There has been no similar agricultural program that has had as much support and enthusiasm of Yankee farmers as the Green Pastures Contest. The New England committee in charge of the contest says that the success of this year's program indicates that an annual contest would be well received. Plans to continue the contest on a yearly basis are now being made.

New England cows, dreaming of greener pastures and better hay, are certain of having their dreams fulfilled this year and in the years ahead. The Green Pastures Contest not only makes every farmer a winner, but also gives some welcomed prizes in the form of lush green feed to the dairy animals as well.

# How Much Lime Should We Use?

*By V. A. Tiedjens*

Director, Virginia Truck Experiment Station, Norfolk, Virginia

THERE is much discussion pro and con about how much lime should be used on naturally occurring acid soils. Fragmentary evidence indicates that we should use much more lime than we are using at the present time. On the other hand, we have much published data showing that there is danger of getting too much lime. With so many conflicting reports we hesitate to tell a grower what to do because we don't seem to be able to agree on the same program. This has prevented us from getting maximum yields and has retarded our research program. It has not only stifled experiments on the use of lime but it has stifled experiments on the use of fertilizer. By this I mean that the results from many of our experiments are limited and often worthless from the grower's point of view because we have overlooked the importance of having the soil in the proper physical condition before we lay out our experiments.

I have in mind a farm on the Eastern Shore of Virginia where the grower started out with an acid Sassafras soil. The crop was potatoes. This land received 3,000 pounds of pulverized magnesium limestone every year for six years. The yield started from 75 bags per acre and at the end of the seventh year had increased to 225 bags or 375 bushels of Cobbler potatoes per acre. A good cover crop system was followed. The land was plowed deeper every year until in 1948 this land was plowed 11 inches deep. The pH of this soil is 6.4 at the present time. Potato and cover crop roots go down below the 2-foot level. I haven't followed the roots any deeper than that. This land is in ideal condition for experiments involving fertilizer quantity and placement as well as cultural practice experiments, because the subsoil is in a condition to support extensive root growth. The field has not produced any potato scab up to the present time and yet we are warned against getting the pH above 5.5 because of encouraging the development of scab. Here we have a case where a grower started out on a soil that supposedly was good for potatoes and yet with unorthodox methods has increased his yield by increasing the lime content and still hasn't had difficulty with scab.

But we do grow potatoes on limestone soil as well as on lime marl with less scab than we get on acid soils as low as pH 4.7.

### The Most Productive Soil

A limestone soil if properly fertilized is our most productive soil. Crop production on such soils is more economical since they are well supplied with calcium and magnesium. They are well aerated where properly drained, and a given amount of plant nutrients produces more food than on our unlimed acid soils. Data from plot experiments on limestone soils are reliable and can be corroborated.

We can take a lesson from such soils in trying to build up our acid soils. We can't make a limestone soil out of our Sassafras soils, but by the proper use of lime we can make a Sassafras soil as productive as our best limestone soils. However, such soils need to have lime applications at regular intervals to maintain a level close to the required amount. Partial liming is not sufficient. When we once have the lime requirement satisfied we can conduct plot experiments and obtain data which can be corroborated on other limed soils of

similar type. This means that our first problem is to get our base exchange complex in order before we can hope to get anywhere with horticultural or agronomic experiments dealing with cultural or nutrient requirement studies.

### Possible Crop Yields

Possible crop yields per acre make for interesting speculation. Many of our practices often stimulate small increases in yield when obtained from plot experiments. Too often these yields reflect only the effect of a given treatment on a soil which potentially should produce two or three times the yield obtained from the highest-producing plot. Many experiments have shown rather striking increases in yield from certain treatments and yet the highest-yielding plot was still not producing a profit.

The difficulty seems to come about because of the people who conduct the experiments. People interested in soils conduct the experiments with the idea of establishing the ideal rooting media. The horticulturist takes a given piece of soil, good or poor, and tries to find out how to apply fertilizer and how much to use, whether mulching is a good practice, whether irrigation is beneficial, or whether minor elements are necessary. Very often the increases obtained with one treatment may also be obtained with another treatment. For instance, a mulch which protects shallow roots may have the same effect that a lime application will have if it causes the plants to root more deeply. Any results obtained too often are applicable only to that particular piece of ground.

We have known about the effect of lime on cropland for a long time, but in spite of all that has been written about lime and its effect on plant and soil chemistry we do not seem to be able to agree on a common practice.

Most of our potato soils are too acid. The crop grows entirely in the plowed layer and this in many cases is not over five inches. Fertilizer experiments on such soils are a waste of time. Yield differences from plots on such soils are small and have gotten us nowhere because the highest yield obtainable is less than 100 bags per acre. Compare this with similar experiments on limed soil where the yield is two to three times as high. Lime content is the limiting factor and therefore must be satisfied first. Yield data on such soils vary with treatments, but it is difficult to get the same treatment to produce the highest yield more than one year in three or four. These results do not help us when it comes to making recommendations to our growers.

### Changing Practices

I would hesitate to tell a grower to change his practice when experiments showed a significant increase of only 10 per cent in yield obtained from a treatment different from his own. When one or two growers in any given area can consistently produce 400 to 600 bushels of potatoes per acre when the average of the whole area is 200 bushels and experimental plot data show 250 bushels for the best treatment, I don't feel that we have done much for the grower. Obviously the climate is suitable for 400 to 600 bushels. We haven't found the secret when we get only 250 bushels. That secret must be somewhere in the soil, particularly when the 400-bushel grower obtained his yields with the same amount of fertilizer applied in the same manner on the same soil type. Sometimes the reason is obvious if we take the time to look for it. In some cases it is not easy to find.

A grower asked me to tell him why a field of his didn't produce a crop. The soil seemed similar to other land on which he was growing good crops. A fertilizer experiment was established on the field. The soil was white sand of the Keyport type with no profile development. The pH of the soil was 5. We decided that because the soil was so acid we would apply 1,000 pounds of magnesium limestone per acre on the

bottom of the plow furrow. We planted sweet potatoes. The yields on the plots ranged from 198 to 240 bushels per acre but the differences were not significant. The high average yield we got was due entirely to the 1,000 pounds of limestone per acre. The lowest-yielding plots were located in an area which ran diagonally across the field. The area without limestone but fertilized with one of the best treatments in the experiment yielded 55 bushels per acre.

### Methods of Application

In 1947 we planted corn in a field which had produced 55 bushels of corn per acre in 1945. Plots were established to compare dry and solution sidedressings. Part of the field was planted to some 30 varieties in replicated plots. These plots yielded from 146 to 204 bushels per acre with 20 bushels necessary for a significant difference. The stalks were nine inches apart in the row and the rows three feet apart. In the sidedressing plots the plants averaged 20 inches apart and the rows three feet apart. U. S. 357 which yielded 170 bushels in the variety test was used in these plots. The yield ranged from 94 to 134 bushels per acre. This soil was a sandy loam to loam with a gravelly clay subsoil.

This field received 3½ tons of magnesium limestone which was plowed under with 1,000 pounds of 5-10-5 fertilizer. However, as the soil was plowed, a subsoiler was run in the furrow to a depth of 20 inches. Everyone who saw this field of six acres of corn said it was the best corn he had ever seen. I have made the statement to growers that many soils in Tidewater Virginia should yield 300 bushels of shelled corn per acre. I realize that we have set our sight pretty high but I hope to demonstrate that with the lime requirement properly satisfied to a depth of two feet, with plowing at least 10 inches deep, and with a ton of fertilizer plowed under, it is possible to get these high yields.

When the crop was removed, the profile of this soil was examined and roots were found 20 inches deep and went down below this level. Spinach growers like to grow a crop of corn in rotation with their spinach. These soils are well-limed and the yield of corn in one 40-acre field averaged 97 bushels per acre. Spinach following such a corn crop will yield 800 bushels per acre.

I have compared subsoiling with and without limestone, but the subsoiling does not increase yields very much. It is the large quantities of limestone which seem to be responsible for jumping the yields.

### More Observations

The above field treatments were based on observations made on plot experiments where up to 10 tons of limestone per acre were applied. We have compared hydrated lime and limestone in equivalent amounts from 1 to 10 tons of magnesium limestone. The spinach plants on the 10 tons of limestone were by far the largest. The high hydrated lime plots were almost as good but the quality was not as good. Results from these plots have not been reported because we did not have good enough stands to warrant taking yield data. As soon as we get yield data that can be calculated without having to correct for too many factors, it will be published. The interesting thing about these plots is the fact that abnormalities which occurred on plants showed up on the low lime plots. The reason for this is the effect that the lime has on the soil. We are using these high quantities to try to get the limits of injury or improvement.

Many of our soils have a lime requirement of 2 to 4 tons of limestone per acre. Since this is based on an acre foot, obviously 2- to 4-ton applications are not sufficient because we have to correct the $A_2$ and B horizons as well as the surface. By determining the lime requirement to a depth of two feet we run into staggering figures. In order to get growers to see this, we

recommended that they apply increasing amounts in strips across their fields and let them decide whether they should use 1 or 5 tons per acre. I told an asparagus grower to do this a number of years ago and he got no response to 1, 2, 3, or 4 tons per acre but got a big response to 5 tons of magnesium limestone per acre. He applied 5 tons per acre to his 40-acre field and several years later he told me it was the best investment he ever made.

There is much to be learned about the use of lime, but unless we are willing to get away from some of our book knowledge we don't learn much about its use. There are many growers who are using heavy applications of liming material. I have in mind alfalfa growers who have applied 6 to 8 tons of lime per acre and have obtained amazing yields. At the same time we have many investigators who will swear by all that is holy that we will ruin our soils by overliming. I don't believe any grower has money enough to overlime his soil. By this I mean that he probably won't overlime beyond the point where the soil complex is saturated.

I have had overliming injury, but not from heavy applications of dolomitic limestone. I have used one ton of hydrated lime and had plant symptoms show up which could be called overliming injury. The yield was poor compared to no lime. However, when I used enough lime to satisfy the needs of the soil to a depth of two feet, the "overliming" injury disappeared. I can only guess what has happened. On Coastal Plain soils that have a dense plow sole, one ton of hydrated lime is not enough to correct the acidity of the plowed layer. The high calcium upsets the ion equilibrium of the soil because only the plowed layer is affected. There is little chance for soluble salts to reach through the plow sole. This happens when the lime is applied after the ground is plowed. Furthermore, the salts tend to move to the surface where most of the feeding roots are located. Under such conditions, 500 pounds of hydrated lime are sufficient. What is actually happening is that we are supplying the plant with calcium. We are not trying to change the soil complex.

However, when enough lime is applied to correct acidity to a depth of two feet, the plow sole is affected and plant roots penetrate this layer. When once through this 2- to 4-inch layer they continue to go deeper. This tends to encourage seepage and diffusion promoting better drainage and aeration. Much of our overliming injury is not due to the lime as much as it is to poor drainage and aeration. This is more prevalent in our sandy soils than in the loam soils where the plow sole is less dense. This is not always easy to see. We think of our sandy loams as being better drained and aerated than our loam and clay loam soils when as a matter of fact our problem is far more severe on our sandy loams. Ponds after heavy rains are more severe and do more crop damage on the sandy soils than on the heavier soils.

This question of drainage and aeration was well shown on our Station land. When we first started our deep tillage and heavy liming work, there were certain fields that could not be used because water did not penetrate and our chief concern was to provide ditches and drains to carry off the surface water without eroding the surface and incidentally carrying off much of the nutrient supply. Since we have supplied up to as much as 10 tons of limestone per acre, plowed deeper, and subsoiled where necessary, we find that the fields that formerly could be farmed only after several weeks following a heavy rain now can be worked and planted before the sandier higher land. We now have very little runoff and have no difficulty farming shortly after a heavy rain.

I feel that this conditioning of the soil is the real secret of large yields. The water is stored in the subsoil, the

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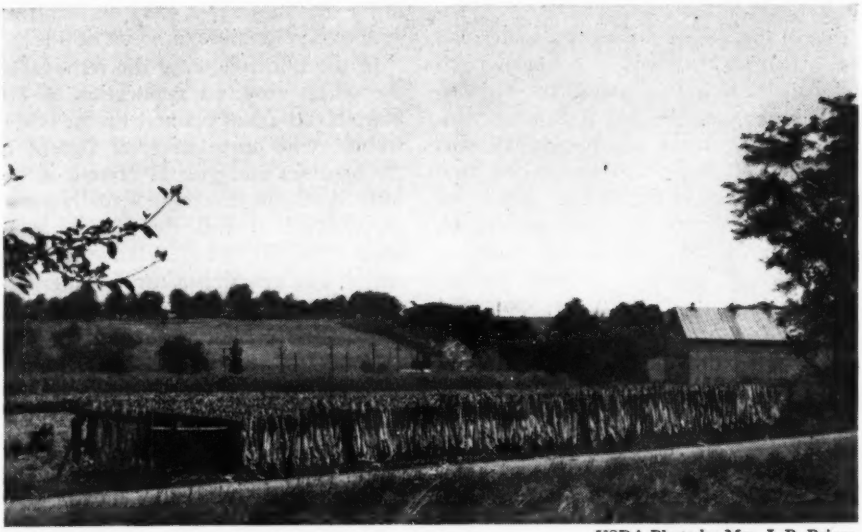


USDA Photo by Mrs. J. P. Briggs

**Fig. 1. Scene showing air-curing or so-called scaffolding of tobacco preparatory to shed curing.**

# A Soil Management Program for Penn Tobacco Farmers

*By Orman E. Street*[1] *and Clifford O. Jensen*[2]

Pennsylvania State College, State College, Pennsylvania

THE growth of cigar filler tobacco in Pennsylvania is limited to a group of counties in the southeastern portion of the State. Of these counties, Lancaster produces the larger portion of the crop, while smaller amounts are grown in York, Lebanon, Berks, Dauphin, Northumberland, and Snyder Counties.

The rotations in use in this area have been established by custom and convenience with the most popular succession of crops being a four-year rotation of tobacco, winter wheat, hay, and corn. Some variations occur in this rotation. Winter barley may be substituted for winter wheat. The hay crop may be alfalfa, mixed clovers, legumes and timothy or the more customary planting of red clover and timothy.

When there is an increased demand for vegetable crops, tomatoes, potatoes, or truck crops may be grown instead of field corn. This last departure is generally beneficial as a higher level of fertilization is practiced for these crops than for field corn and the soil is consequently enriched for the succeeding tobacco crop. Also, tomatoes and pota-

[1] Agronomist, Tobacco Experimental Station, Lancaster, Pa.

[2] Professor of Phytochemistry, Penn State College, State College, Pa.

toes seem to leave a more desirable residue in the soil than the roots and stalks of corn, and somewhat better tobacco is usually found following these crops.

A three-year rotation of tobacco, winter wheat, clover or mixed hay was formerly popular but has fallen into disuse because of the inferior quality of the tobacco crop which immediately follows the sod. The shorter rotations practiced in some tobacco areas, including continuous culture of tobacco, are seldom used in this area. A few farmers have been quite successful in a two-year rotation of tobacco and wheat or tobacco and rye, but incorrect management is quickly evident in a shorter rotation and most farmers avoid this rotation.

Except for the fertilization of tobacco, which is commonly supplied with 1,000 pounds of a 4-8-12 grade per acre and with practically all the manure which is produced on the farm, the crops in the rotation are usually not fertilized. Unless the season has been unusually dry, the tobacco crop will use the greater part of the fertilizer supplied. In years of average to heavy summer rainfall, winter wheat should receive 400 to 500 pounds of 3-12-6 per acre, while following a dry summer it may be fertilized with a corresponding amount of 0-12-12.

In the fall, following the removal of the wheat crop, an application of 250 pounds of 0-20-20 per acre on the wheat stubble will prove of great benefit to the legumes and grasses present in the soil. As the legume crop actually grows on the soil a full two years, being seeded in the wheat stand in early spring and remaining through that entire season and until June of the second year, it should not be neglected.

With the almost universal adoption of hybrid corn, yields have skyrocketed and little attention has been paid to the consequent increased removal of plant nutrients. It is now generally recognized that the plowing under of corn fertilizer in the furrow sole or broadcast before plowing is a good practice. From 500 to 800 pounds of 10-10-10 per acre should be applied in this manner plus 150 to 200 pounds of 3-12-6 applied with the planter.

Soil management practices which maintain organic matter at optimum levels are needed for all cultivated crops. If the silt and clay loam soils of southeastern Pennsylvania are to remain till-

USDA Photo by Mrs. J. P. Briggs

**Fig. 2. Scene showing tobacco curing barn with ventilators open.**

able, it becomes necessary to include a sod crop in the rotation and, if possible, to return most of the product of this crop to the soil. The removal of all top growth of clover, alfalfa, or grass mixtures cannot fail to defeat the purpose for which the crops are grown. Failure to fertilize the sod crop results in a net deficit in mineral supply of the soil and likewise produces a residue which is more difficult to decompose.

Cover crops in corn serve the same purpose as sod crops in supplying organic matter and in conserving plant nutrients. Most farmers now plant rye grass at the time of the last cultivation of corn and if the weather is not too dry, a good stand will result. If the rye grass fails, rye may be seeded as an emergency cover crop until November 1. Brome grass or orchard grass is equally as effective as rye grass but the price of the seed has been somewhat higher.

The winter wheat occupies the ground from shortly after the removal of the tobacco crop, usually being seeded in early October and being harvested in the following July. If the straw is cut low and removed, the net result is a lowering of the organic matter supply. Allowing the straw to remain as a mulch will result in a net increase in organic matter—also aid the growth of the legume crop. As this is rather an infrequent practice due to the desire of the farmer to use the straw for bedding, the best alternative may be a light fall dressing of manure on the wheat stubble.

The entire question of the best practices in handling manures both in the barn and in the field is now a subject of renewed interest. Recent recommendations for the application of superphosphate (or caustic or hydrated lime) to poultry manures could well be extended to the common stable manures, certainly to the extent of recommending the application of superphosphate at the rate of one pound per animal per day. If manure could be hauled into the field every day and immediately incorporated into the soil, an ideal situation would be present. Storage under cover to prevent leaching by rain and loss of nitrogen and potash is also valuable. Adequate use of bedding to reduce moisture content will reduce overheating and consequent loss of ammonia. A liquid portion containing more than half of the nitrogen and potash is often allowed to go to waste. More adequate use of bedding would absorb the liquid and permit its transfer to the field.

USDA Photo by Mrs. J. P. Briggs

**Fig. 3. Judging quality of tobacco by the feel and graininess of the leaf.**

The timing of manurial applications has been given little consideration in the past. The high acre income from tobacco has tempted the farmer to put all his available manure on the land to be used for that crop. The best crop in the rotation on which to apply manure is probably not the tobacco crop. A light dressing on the wheat stubble will assist the overwintering of the legumes present while if fall seeding of legumes or pasture haylands are made, a light manuring will increase the legume stand as much as 100 per cent. With the supply of these seeds being scarce and high in price, this practice

is strongly urged. A further opportunity for use of the manure may be a fall or winter application on the sod stubble. This may be a heavier coating than the application in the wheat stubble as the succeeding corn crop will receive the full benefit of the manure and the effect will also be present for the tobacco crop in the second year.

Some direct experimental evidence has been obtained on the relative value of manure applied to preceding crops as compared with manure applied directly to the soil in the year in which tobacco is grown. The preceding crops naturally benefited to a great extent from this manure, especially such cultivated crops as tomatoes, potatoes, sweet corn, or field corn. The average difference in yield of the succeeding tobacco was only 67 pounds per acre total yield in favor of the application of the manure in the tobacco year. In many instances, the yield of tobacco was greater where the manure was applied to the preceding crop, especially if the preceding crop grew in a dry season. In contrast with the cultivated crops, tobacco following clover was uniformly better in yield and quality if the manure was applied to the clover in the year preceding. Apparently, the combination of manure and a heavy clover sod resulted in an oversupply of slowly decomposable organic matter which interfered with the growth of the tobacco crop during the early part of the growing season. Later in the season when the tobacco should mature, the nitrogen supply was too abundant and the crop failed to ripen properly.

Although it is hardly necessary to cite evidence on the value of fertilizer and manure for tobacco, recent results in Pennsylvania re-emphasize the importance of such applications. In a nine-year test, unfertilized tobacco following clover produced an average yield of less than 1,200 pounds per acre. In a later test, somewhat higher yields were obtained on more fertile soil but the addition of fertilizer alone increased the yield from 300 to 500 pounds per acre, while the use of fertilizer plus manure raised the yield to an average of nearly a ton per acre in a three-year period.

One of the questions arising in connection with the use of manures is the comparative value of various sources. Because of the widespread interest in this subject, a comparison of 11 manurial treatments was started at the Tobacco Experimental Station at Lancaster in 1941 and continued for a period of six years through 1946. Among manures applied at 15 tons per acre and plowed under in the spring, the best yield was secured from an application of a partly rotted mixture of horse and stockyard manure. This mixture has long been recognized as superior because the horse manure aids the decomposition of the heavier and colder steer manure which in turn prevents "fire-fanging" of the horse manure. Actually, the source was not pure steer manure but manure obtained from the local stockyards and this averaged about 90 per cent steer manure.

The second largest yield was obtained with sewage sludge obtained from the Lancaster Sewage Disposal Plant. It invariably produced large vigorous tobacco notable for its dark green color. This material contained about four per cent nitrogen, the larger portion of which was available because of the activation of the sludge. It has also been used successfully by market garden growers, especially for the production of celery.

A surface dressing or mulch of fresh strawy stockyard manure applied at the time of planting the tobacco was surprisingly effective in promoting yield and quality. In contrast, the same material plowed under showed excellent results in the wet years of 1942 and 1944 and rather poor results in the dry years of 1941 and 1943. This would immediately suggest that partial rotting in the pile would help overcome the adverse effects of the fresh material in a dry year. This conclusion is only true

(*Turn to page* 41)

**The difference between the old and the new pattern of farming. The pattern on the right means less erosion and higher production.**

# Soil Conservation Raises Midwest Crop Potentials

*By L. R. Combs*

Soil Conservation Service, Milwaukee, Wisconsin

WHAT will happen to total farm output in the Corn Belt and Lake States when a complete soil and water conservation plan is applied to all the agricultural land?

Some of the more important changes that may occur are:

A 2-billion-bushel average farm crop per year, or about 30 per cent above the average for the four pre-war years, although corn acreage would decrease from 38.4 million to 35 million acres.

A 10 per cent increase in total small grain production from a smaller acreage.

More than twice as much feed from hay and rotation pastures as before the war.

About double the feeding value from permanent pastures.

A 20 to 25 per cent increase in dairy production; more than a doubling of beef production; and pork production at about 1937-1941 levels.

In spite of these increases in livestock numbers, farmers would still raise and ship out considerably more feed grains, especially corn, than would be required in the North Central States.

These facts are revealed by a study recently completed by George H. Walter, Agricultural Economist, Bureau of Agricultural Economics, Milwaukee, Wisconsin. Using figures on present land use, the capabilities of land, and conservation needs already developed

by the U. S. Soil Conservation Service, Mr. Walter determined the possible effects on production if a soil conservation program were applied to all the agricultural lands of the eight-state Upper Mississippi Region. This region includes Minnesota, Missouri, Michigan, Iowa, Illinois, Indiana, Ohio, and Wisconsin. Entitled "Possible Effects of Conservational Land Use on Production in the Corn Belt and Lake States," the report of his study is the first of its kind.

A complete program of soil and water conservation, developed and applied farm by farm and acre by acre, would involve shifting land to its best and most profitable use, the necessary soil treatment and adapted rotations, and the use of contouring, terracing, strip-cropping, grassed waterways, and other practices as needed.

If land in the Upper Mississippi Region were put to its best and most profitable use, farmers would shift 24.6 million acres of permanent pasture and idle land into crops. At the same time they would change 24.5 million acres of cropland to other purposes for which it is better adapted.

The net increase in land for crop production (compared to the year 1939) would be only 100,000 acres. But the land shifted to cultivated crops ordinarily would produce more grain than that taken out of cropland. This new cropland would be more level, less erodible, and would have a higher fertility level capable of producing larger yields per acre. At the same time, land not so suitable for rotation crops and shifted to permanent hay or pasture would produce about as much forage as the land taken out of meadow. Thus, the situation is almost one of "have your cake and eat it too."

The use of better rotations and shifts in the use of the open land would result in a 28 per cent increase in the acreage of hay and rotation pastures. At the same time row-crop acreage would decrease 6 per cent and small grain acreage 16 per cent. Farmers would concentrate grain production on the highly productive and less rolling land.

On some of the nearly level and gently rolling land, rotations including enough legumes and grasses would control erosion. But to follow such rotations would necessitate considerable reorganization on many farms. The amount of roughage produced on a farm or in an area might easily exceed the amount which the possible livestock numbers could consume.

If rotations alone were relied upon to control erosion on more level land, only 38.8 million acres in these eight states could safely be planted to row crops in any average year. The average acreage of row crops during the four pre-war years was 46.9 million. In addition, use of rotations alone to control erosion would decrease small grain acreage from the 38.9 million acres grown before the war to 32 million acres. At the same time such a system would increase the acreage of rotation pasture and hay from a pre-war average of about 42 million to about 60 million acres.

When erosion control practices are used in connection with the rotations, farmers find it possible to have a much larger proportion of small grain and row crops in rotation without danger of erosion. A soil requiring a 6-year rotation, including four years of meadow, where rotations alone are used to prevent erosion, could be farmed with a 3-year rotation including only one year of meadow if a properly constructed terracing system was used. On the same soil, a 4-year rotation including two years of meadow probably would control erosion if used with strip cropping.

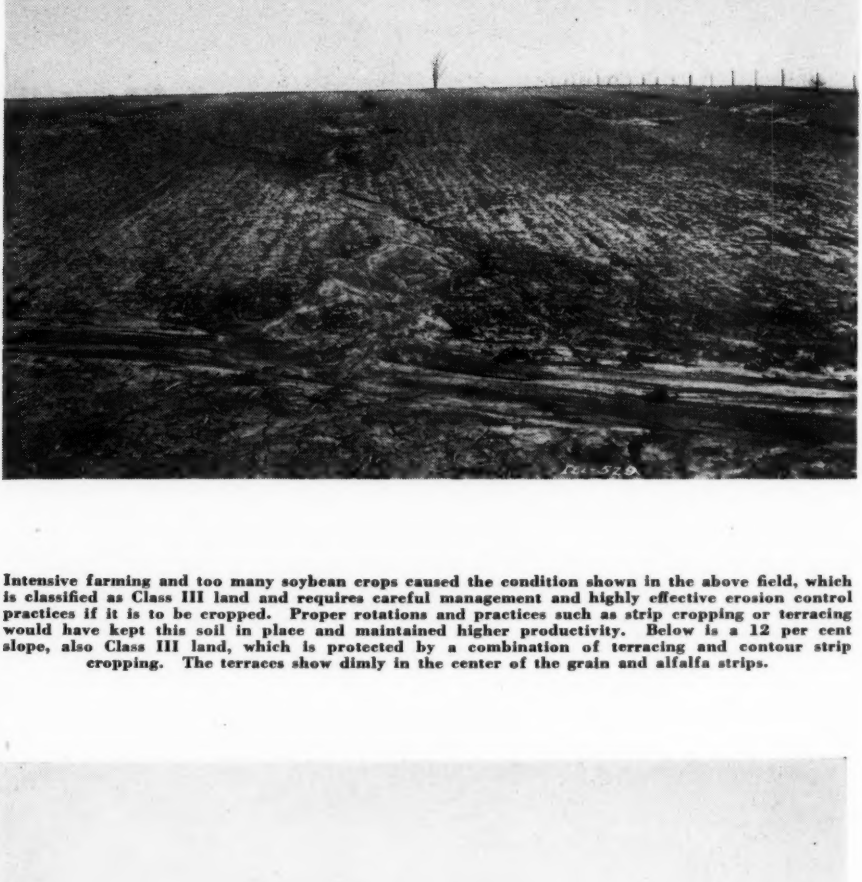
The Soil Conservation Service recommends such practices as terracing, strip cropping, or contour farming on about 54.8 million acres of cropland in the Upper Mississippi Region. Use of these three practices where needed will enable farmers in the eight states to grow 5.6 million more acres of row

(*Turn to page* 43)

**On gently sloping land, contour tillage and other good soil-management practices increase production while checking erosion. Here Robert Ackerman, near Caledonia, Illinois, inspects corn from a contoured field which averaged 101 bushels an acre. A straight-row field at left of this area on same soil type but slightly more level land averaged only 90 bushels—a difference of 11 bushels in favor of contouring.**

**After Wilhelm Steenberg, Cashton, Wisconsin, went "all out" in 1939 and applied a complete farm conservation plan, he increased his Guernsey herd (above) from 20 to 30 without buying additional feed. Before then, erosion almost had him backed into a corner because the land had been used too hard. Now his corn, of which he previously could grow only a few acres, yields about 100 bushels per acre. Below, Steenberg and his son, Howard, harvest oats which now yield 50 to 65 bushels per acre instead of the former 20.**

**Overgrazed and unfertilized, this pasture (above) on the Steve Whitish farm near Fennimore, Wisconsin, was furnishing little forage and was beginning to show evidence of gullying. Then the operator renovated it as part of his complete farm conservation plan. After disking, liming and fertilizing, and reseeding to a mixture of clovers, alfalfa, and timothy, the pasture (below) is furnishing good forage for the dairy herd and erosion is at a standstill. A good stand of clovers and grasses has been established by soil treatment and renovation.**



Intensive farming and too many soybean crops caused the condition shown in the above field, which is classified as Class III land and requires careful management and highly effective erosion control practices if it is to be cropped. Proper rotations and practices such as strip cropping or terracing would have kept this soil in place and maintained higher productivity. Below is a 12 per cent slope, also Class III land, which is protected by a combination of terracing and contour strip cropping. The terraces show dimly in the center of the grain and alfalfa strips.

# The Editors Talk

## Urban Agricultural Extension

August 18, on a 175-acre farm near Jefferson, Maryland, there was staged for "town and country" the biggest and most complete farm demonstration yet to be recorded. In fact, the scope of influence of this demonstration transcended town and country. It was international, since because of the location's proximity to Washington, D. C., many embassies of foreign countries sent representatives to view and learn from the spectacle.

The occasion was the making over, in a single day, the farm of Mrs. Nellie Thrasher, a widow with two teen-age children. It is estimated that 50,000 people were on hand to watch the modern miracle performed largely under the supervision of the Soil Conservation Service. Some 500 enthusiastic neighbors and agriculturists, using cheerfully donated equipment and supplies, changed gully-scarred fields into areas efficiently contoured to conserve soil and moisture, fertilized and planted them according to best land-use practices, and then put up fences. They worked in her woodland, made and stocked a farm pond, built a new 23-cow dairy barn, and constructed farm roads. They painted her house, re-landscaped the yard, filled the new silo, and performed innumerable other tasks in bringing the 200-year-old farm into modern efficiency.

This was not a charity project nor was it paid for by government agencies. It was a demonstration put on to educate the public on our national needs for and the benefits to be derived from modern farming methods, and it was made possible by voluntary contributions of services and materials. Mrs. Thrasher's farm was chosen chiefly because of its location and its possibilities for demonstrating the most improvement operations.

The idea of such a farm "face-lifting" was not original in the Maryland instance. There have been such demonstrations in Iowa, Virginia, and other states. So successful have they been that several commonwealths and communities already are making similar plans for this method of reaching the greatest number of people in the shortest possible time. Some thirty representatives from other states attended the Maryland affair to observe procedures. The very fact that a whole farm can be remodeled in a single day catches the imagination and curiosity of people who otherwise might not become aware that our declining soils are a very real and impending threat to our civilization. In the demonstration they see, as Secretary of Agriculture Charles F. Brannan put it, "concrete signs of human ability to mold the future."

"We see a demonstration of what people can do, if they wish, toward determining their own destiny, rather than permitting their destiny to be decided by the actions and the precedents of former generations," he said. "That is a good sign. There is another. We see here today a demonstration of the American people's awareness that the land is important and that its conservation is essential to our continued well-being. In this remaking of a farm in a single day, we see a means

of helping to increase the future food supply of this country and the world, and thus of making a more prosperous and a brighter future for ourselves, our children, our children's children, and for all the coming generations of all the peoples of the earth."

In further remarks, Secretary Brannan broadened the meaning of conservation. He saw the recognition that conservation means more than just land and forest practices. "Yes, it means drainage, terracing, strip-cropping, contouring, pasture improvement, liming, and many other practices. But it is larger than those things. It means care of the house and buildings. It means efficient use of machinery. It means control of insects and diseases. It means good breeding and feeding of livestock. Conservation runs the whole gamut of good farm management."

William Preston Lane Jr., Governor of Maryland, proclaimed that the very presence of so great an assemblage of people is evidence that our citizenry, in all walks of life and occupations, is alive to the urgency of combating the greatest enemy attacking our natural resources, erosion of our life-sustaining soil. "Before the end of the month," he said, "this story of cooperation will have been carried to all sections of the globe by our overseas press and radio, including the facilities of the World-Wide Broadcasting Foundation and the State Department's 'Voice of America.'"

We in this country have become used to things done in a big way. But farm re-modeling in a single day is probably the biggest thing yet to come to our famous extension services. With such demonstrations, agricultural extension is truly becoming urban, and beyond that international. Let us have many more of them.

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## The Yearbooks of Agriculture

Now a valued addition to many official and personal libraries is "Grass," the Yearbook of Agriculture—1948, released on July 31. This 890-page volume is the "first word, so to speak, on the subject of grass, legumes and the associated herbage," and brings together the best information available on grass and grassland culture. The book has four main sections: The first, "Grass in the Nation's Life," treats the subject generally. "Grass in the Ten Regions," discusses grass by climatic and soil regions of the United States, Alaska, Hawaii, and Puerto Rico, and enables a reader to refer easily to facts and figures affecting his particular area. "Grass in a Plant Round-up" is designed for those interested in identification of specific grasses and legumes. Individual description as to appearance, growth habits, regions of adaptations, and drawings of many of the plants permit recognition and selection. The fourth, "Grass in Tables and Charts," contains information on seeding mixtures, recommended maintenance practices, and factors of economic importance, by regions.

Again, the U. S. Department of Agriculture is to be highly congratulated for this latest number in their series begun in 1936—a series destined to be a veritable encyclopedia of farm science. A review of the other books in the series discloses the broad objective of the plan: "Better Plants and Animals I," 1936; "Better Plants and Animals II," 1937; "Soils and Men," 1938; "Food and Life," 1939; "Farmers in a Changing World," 1940; "Climate and Man," 1941; and "Keeping Livestock Healthy," 1942. With publishing interrupted during the war, the next volume covering 1943-47 was called "Science in Farming" and surveyed the achievements of agricultural science during the interval. The 1949 yearbook, already being planned, will deal with trees and forests.

## Season Average Prices Received by Farmers for Specified Commodities *

| Crop Year | Cotton Cents per lb. | Tobacco Cents per lb. | Potatoes Cents per bu. | Sweet Potatoes Cents per bu. | Corn Cents per bu. | Wheat Cents per bu. | Hay Dollars per ton | Cottonseed Dollars per ton | Truck Crops |
|---|---|---|---|---|---|---|---|---|---|
| | Aug.-July | ..... | July-June | July-June | Oct.-Sept. | July-June | July-June | July-June | .... |
| Av. Aug. 1909–July 1914 | 12.4 | 10.0 | 69.7 | 87.8 | 64.2 | 88.4 | 11.87 | 22.55 | .... |
| 1923 | 28.7 | 19.0 | 92.5 | 120.6 | 82.5 | 92.6 | 13.08 | 41.23 | .... |
| 1924 | 22.9 | 19.0 | 68.6 | 149.6 | 106.3 | 124.7 | 12.66 | 33.25 | .... |
| 1925 | 19.6 | 16.8 | 170.5 | 165.1 | 69.9 | 143.7 | 12.77 | 31.59 | .... |
| 1926 | 12.5 | 17.9 | 131.4 | 117.4 | 74.5 | 121.7 | 13.24 | 22.04 | .... |
| 1927 | 20.2 | 20.7 | 101.9 | 109.0 | 85.0 | 119.0 | 10.29 | 34.83 | .... |
| 1928 | 18.0 | 20.0 | 53.2 | 118.0 | 84.0 | 99.8 | 11.22 | 34.17 | .... |
| 1929 | 16.8 | 18.3 | 131.6 | 117.1 | 79.9 | 103.6 | 10.90 | 30.92 | .... |
| 1930 | 9.5 | 12.8 | 91.2 | 108.1 | 59.8 | 67.1 | 11.06 | 22.04 | .... |
| 1931 | 5.7 | 8.2 | 46.0 | 72.6 | 32.0 | 39.0 | 8.69 | 8.97 | .... |
| 1932 | 6.5 | 10.5 | 38.0 | 54.2 | 31.9 | 38.2 | 6.20 | 10.33 | .... |
| 1933 | 10.2 | 13.0 | 82.4 | 69.4 | 52.2 | 74.4 | 8.09 | 12.88 | .... |
| 1934 | 12.4 | 21.3 | 44.6 | 79.8 | 81.5 | 84.8 | 13.20 | 33.00 | .... |
| 1935 | 11.1 | 18.4 | 59.3 | 70.3 | 65.5 | 83.2 | 7.52 | 30.54 | .... |
| 1936 | 12.4 | 23.6 | 114.2 | 92.9 | 104.4 | 102.5 | 11.20 | 33.36 | .... |
| 1937 | 8.4 | 20.4 | 52.9 | 82.0 | 51.8 | 96.2 | 8.74 | 19.51 | .... |
| 1938 | 8.6 | 19.6 | 55.7 | 73.0 | 48.6 | 56.2 | 6.78 | 21.79 | .... |
| 1939 | 9.1 | 15.4 | 69.7 | 74.9 | 56.8 | 69.1 | 7.94 | 21.17 | .... |
| 1940 | 9.9 | 16.0 | 54.1 | 85.5 | 61.8 | 68.2 | 7.58 | 21.73 | .... |
| 1941 | 17.0 | 26.4 | 80.7 | 94.0 | 75.1 | 94.4 | 9.67 | 47.65 | .... |
| 1942 | 19.0 | 36.9 | 117.0 | 119.0 | 91.7 | 110.0 | 10.80 | 45.61 | .... |
| 1943 | 19.9 | 40.5 | 131.0 | 204.0 | 112.0 | 136.0 | 14.80 | 52.10 | .... |
| 1944 | 20.7 | 42.0 | 149.0 | 192.0 | 109.0 | 141.0 | 16.40 | 52.70 | .... |
| 1945 | 21.2 | 36.6 | 143.0 | 204.0 | 127.0 | 150.0 | 15.10 | 51.10 | .... |
| 1946 | 28.3 | 38.2 | 124.0 | 219.0 | 156.0 | 191.0 | 17.30 | 71.40 | .... |
| 1947 | | | | | | | | | |
| August | 33.15 | 38.1 | 161.0 | 270.0 | 219.0 | 210.0 | 15.30 | 75.50 | .... |
| September | 31.21 | 40.7 | 149.0 | 240.0 | 240.0 | 243.0 | 16.10 | 75.60 | .... |
| October | 30.65 | 41.6 | 150.0 | 205.0 | 223.0 | 266.0 | 16.80 | 90.60 | .... |
| November | 31.87 | 40.0 | 166.0 | 195.0 | 219.0 | 274.0 | 17.30 | 89.10 | .... |
| December | 34.06 | 46.9 | 172.0 | 204.0 | 237.0 | 279.0 | 18.10 | 94.80 | .... |
| 1948 | | | | | | | | | |
| January | 33.14 | 45.9 | 186.0 | 217.0 | 246.0 | 281.0 | 18.70 | 95.10 | .... |
| February | 30.71 | 38.5 | 193.0 | 231.0 | 192.0 | 212.0 | 19.60 | 88.60 | .... |
| March | 31.77 | 29.6 | 196.0 | 237.0 | 211.0 | 221.0 | 19.70 | 87.90 | .... |
| April | 34.10 | 31.2 | 209.0 | 240.0 | 219.0 | 229.0 | 19.40 | 89.40 | .... |
| May | 35.27 | 40.1 | 196.0 | 244.0 | 216.0 | 222.0 | 18.30 | 90.70 | .... |
| June | 35.22 | 41.7 | 187.0 | 246.0 | 216.0 | 211.0 | 17.90 | 92.20 | .... |
| July | 32.99 | 43.6 | 166.0 | 262.0 | 202.0 | 203.0 | 18.20 | 96.00 | .... |

### Index Numbers (Aug. 1909—July 1914 = 100)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1923 | 231 | 190 | 133 | 137 | 129 | 105 | 110 | 183 | .... |
| 1924 | 185 | 190 | 98 | 170 | 166 | 141 | 107 | 147 | 143 |
| 1925 | 158 | 168 | 245 | 188 | 109 | 163 | 108 | 140 | 143 |
| 1926 | 101 | 179 | 189 | 134 | 116 | 138 | 112 | 98 | 139 |
| 1927 | 163 | 207 | 146 | 124 | 132 | 135 | 87 | 154 | 127 |
| 1928 | 145 | 200 | 76 | 134 | 131 | 113 | 95 | 152 | 154 |
| 1929 | 135 | 183 | 189 | 133 | 124 | 117 | 92 | 137 | 137 |
| 1930 | 77 | 128 | 131 | 123 | 93 | 76 | 93 | 98 | 129 |
| 1931 | 46 | 82 | 66 | 83 | 50 | 44 | 73 | 40 | 115 |
| 1932 | 52 | 105 | 55 | 62 | 50 | 43 | 52 | 46 | 102 |
| 1933 | 82 | 130 | 118 | 79 | 81 | 84 | 68 | 57 | 91 |
| 1934 | 100 | 213 | 64 | 91 | 127 | 96 | 111 | 146 | 95 |
| 1935 | 90 | 184 | 85 | 80 | 102 | 94 | 63 | 135 | 119 |
| 1936 | 100 | 236 | 164 | 106 | 163 | 116 | 94 | 148 | 104 |
| 1937 | 68 | 204 | 76 | 93 | 81 | 109 | 74 | 87 | 110 |
| 1938 | 69 | 196 | 80 | 83 | 76 | 64 | 57 | 97 | 88 |
| 1939 | 73 | 154 | 100 | 85 | 88 | 78 | 67 | 94 | 91 |
| 1940 | 80 | 160 | 78 | 97 | 96 | 77 | 64 | 96 | 111 |
| 1941 | 137 | 264 | 116 | 107 | 117 | 107 | 81 | 211 | 129 |
| 1942 | 153 | 369 | 168 | 136 | 143 | 124 | 91 | 202 | 163 |
| 1943 | 160 | 405 | 188 | 232 | 174 | 154 | 125 | 231 | 245 |
| 1944 | 167 | 420 | 214 | 219 | 170 | 160 | 138 | 234 | 212 |
| 1945 | 171 | 366 | 205 | 232 | 198 | 170 | 127 | 227 | 224 |
| 1946 | 228 | 382 | 178 | 249 | 212 | 209 | 146 | 317 | 204 |
| 1947 | | | | | | | | | |
| August | 267 | 381 | 231 | 308 | 341 | 238 | 129 | 335 | 211 |
| September | 252 | 407 | 214 | 273 | 374 | 275 | 136 | 335 | 179 |
| October | 247 | 416 | 214 | 233 | 347 | 301 | 142 | 402 | 238 |
| November | 257 | 400 | 238 | 222 | 341 | 310 | 146 | 395 | 272 |
| December | 275 | 469 | 247 | 232 | 369 | 316 | 152 | 420 | 294 |
| 1948 | | | | | | | | | |
| January | 267 | 459 | 267 | 247 | 383 | 318 | 158 | 422 | 320 |
| February | 248 | 385 | 277 | 263 | 299 | 240 | 165 | 393 | 320 |
| March | 256 | 296 | 281 | 270 | 329 | 250 | 166 | 390 | 295 |
| April | 275 | 312 | 300 | 273 | 341 | 259 | 163 | 396 | 340 |
| May | 284 | 401 | 281 | 278 | 336 | 251 | 154 | 402 | 262 |
| June | 284 | 417 | 268 | 280 | 336 | 239 | 151 | 409 | 213 |
| July | 266 | 436 | 238 | 298 | 315 | 230 | 153 | 428 | 213 |

## Wholesale Prices of Ammoniates

| | Nitrate of soda per unit N bulk | Sulphate of ammonia bulk per unit N | Cottonseed meal S. E. Mills per unit N | Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N | Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N | High grade ground blood, 16–17% ammonia, Chicago, bulk per unit N |
|---|---|---|---|---|---|---|
| 1910–14 | $2.68 | $2.85 | $3.50 | $3.53 | $3.37 | $3.52 |
| 1924 | 2.99 | 2.44 | 5.87 | 5.02 | 3.60 | 4.25 |
| 1925 | 3.11 | 2.47 | 5.41 | 5.34 | 3.97 | 4.75 |
| 1926 | 3.06 | 2.41 | 4.40 | 4.95 | 4.36 | 4.90 |
| 1927 | 3.01 | 2.26 | 5.07 | 5.87 | 4.32 | 5.70 |
| 1928 | 2.67 | 2.30 | 7.06 | 6.63 | 4.92 | 6.00 |
| 1929 | 2.57 | 2.04 | 5.64 | 5.00 | 4.61 | 5.72 |
| 1930 | 2.47 | 1.81 | 4.78 | 4.96 | 3.79 | 4.58 |
| 1931 | 2.34 | 1.46 | 3.10 | 3.95 | 2.11 | 2.46 |
| 1932 | 1.87 | 1.04 | 2.18 | 2.18 | 1.21 | 1.36 |
| 1933 | 1.52 | 1.12 | 2.95 | 2.86 | 2.06 | 2.46 |
| 1934 | 1.52 | 1.20 | 4.46 | 3.15 | 2.67 | 3.27 |
| 1935 | 1.47 | 1.15 | 4.59 | 3.10 | 3.06 | 3.65 |
| 1936 | 1.53 | 1.23 | 4.17 | 3.42 | 3.58 | 4.25 |
| 1937 | 1.63 | 1.32 | 4.91 | 4.66 | 4.04 | 4.80 |
| 1938 | 1.69 | 1.38 | 3.69 | 3.76 | 3.15 | 3.53 |
| 1939 | 1.69 | 1.35 | 4.02 | 4.41 | 3.87 | 3.90 |
| 1940 | 1.69 | 1.36 | 4.64 | 4.36 | 3.33 | 3.39 |
| 1941 | 1.69 | 1.41 | 5.50 | 5.32 | 3.76 | 4.43 |
| 1942 | 1.74 | 1.41 | 6.11 | 5.77 | 5.04 | 6.76 |
| 1943 | 1.75 | 1.42 | 6.30 | 5.77 | 4.86 | 6.62 |
| 1944 | 1.75 | 1.42 | 7.68 | 5.77 | 4.86 | 6.71 |
| 1945 | 1.75 | 1.42 | 7.81 | 5.77 | 4.86 | 6.71 |
| 1946 | 1.97 | 1.44 | 11.04 | 7.38 | 6.60 | 9.33 |
| 1947 | | | | | | |
| August | 2.53 | 1.60 | 13.01 | 9.98 | 12.75 | 8.73 |
| September | 2.66 | 1.73 | 13.65 | 10.41 | 12.75 | 10.72 |
| October | 2.66 | 1.78 | 15.00 | 10.85 | 12.75 | 13.66 |
| November | 2.66 | 1.78 | 14.22 | 11.06 | 12.75 | 11.53 |
| December | 2.71 | 1.78 | 15.98 | 11.71 | 12.75 | 12.81 |
| 1948 | | | | | | |
| January | 2.78 | 1.83 | 16.22 | 11.71 | 12.75 | 13.28 |
| February | 2.78 | 1.90 | 15.03 | 12.15 | 12.75 | 12.60 |
| March | 2.78 | 1.90 | 13.68 | 12.06 | 12.75 | 9.47 |
| April | 2.78 | 1.90 | 13.87 | 11.71 | 12.75 | 8.35 |
| May | 2.78 | 1.90 | 13.77 | 9.54 | 12.75 | 7.89 |
| June | 2.78 | 1.90 | 14.69 | 9.11 | 8.23 | 8.24 |
| July | 2.78 | 2.07 | 14.56 | 9.22 | 8.80 | 8.73 |

### Index Numbers (1910-14 = 100)

| | | | | | | |
|---|---|---|---|---|---|---|
| 1924 | 111 | 86 | 168 | 142 | 107 | 121 |
| 1925 | 115 | 87 | 155 | 151 | 117 | 135 |
| 1926 | 113 | 84 | 126 | 140 | 129 | 139 |
| 1927 | 112 | 79 | 145 | 166 | 128 | 162 |
| 1928 | 100 | 81 | 202 | 188 | 146 | 170 |
| 1929 | 96 | 72 | 161 | 142 | 137 | 162 |
| 1930 | 92 | 64 | 137 | 141 | 12 | 130 |
| 1931 | 88 | 51 | 89 | 112 | 63 | 70 |
| 1932 | 71 | 36 | 62 | 62 | 36 | 39 |
| 1933 | 59 | 39 | 84 | 81 | 97 | 71 |
| 1934 | 59 | 42 | 127 | 89 | 79 | 93 |
| 1935 | 57 | 40 | 131 | 88 | 91 | 104 |
| 1936 | 59 | 43 | 119 | 97 | 106 | 131 |
| 1937 | 61 | 46 | 140 | 132 | 120 | 122 |
| 1938 | 63 | 48 | 105 | 106 | 93 | 100 |
| 1939 | 63 | 47 | 115 | 125 | 115 | 111 |
| 1940 | 63 | 48 | 133 | 124 | 99 | 96 |
| 1941 | 63 | 49 | 157 | 151 | 112 | 126 |
| 1942 | 65 | 49 | 175 | 163 | 150 | 192 |
| 1943 | 65 | 50 | 180 | 163 | 144 | 189 |
| 1944 | 65 | 50 | 219 | 163 | 144 | 191 |
| 1945 | 65 | 50 | 223 | 163 | 144 | 191 |
| 1946 | 74 | 51 | 315 | 209 | 196 | 265 |
| 1947 | | | | | | |
| August | 94 | 56 | 372 | 283 | 378 | 248 |
| September | 99 | 61 | 390 | 295 | 378 | 305 |
| October | 99 | 62 | 429 | 307 | 378 | 388 |
| November | 99 | 62 | 406 | 313 | 378 | 328 |
| December | 101 | 62 | 457 | 332 | 378 | 364 |
| 1948 | | | | | | |
| January | 104 | 64 | 463 | 332 | 378 | 377 |
| February | 104 | 67 | 429 | 344 | 378 | 358 |
| March | 104 | 67 | 391 | 342 | 378 | 269 |
| April | 104 | 67 | 396 | 332 | 378 | 237 |
| May | 104 | 67 | 393 | 270 | 378 | 224 |
| June | 104 | 67 | 420 | 258 | 244 | 234 |
| July | 104 | 73 | 416 | 261 | 261 | 248 |

## Wholesale Prices of Phosphates and Potash **

| | Superphosphate Baltimore, per unit | Florida land pebble 68% f.o.b. mines, bulk, per ton | Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton | Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1] | Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1] | Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1] | Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1] |
|---|---|---|---|---|---|---|---|
| 1910–14 | $0.536 | $3.61 | $4.88 | $0.714 | $0.953 | $24.18 | $0.657 |
| 1924 | .502 | 2.31 | 6.60 | .582 | .860 | 23.72 | .472 |
| 1925 | .600 | 2.44 | 6.16 | .584 | .860 | 23.72 | .483 |
| 1926 | .598 | 3.20 | 5.57 | .596 | .854 | 23.58 | .537 |
| 1927 | .525 | 3.09 | 5.50 | .646 | .924 | 25.55 | .586 |
| 1928 | .580 | 3.12 | 5.50 | .669 | .957 | 26.46 | .607 |
| 1929 | .609 | 3.18 | 5.50 | .672 | .962 | 26.59 | .610 |
| 1930 | .542 | 3.18 | 5.50 | .681 | .973 | 26.92 | .618 |
| 1931 | .485 | 3.18 | 5.50 | .681 | .973 | 26.92 | .618 |
| 1932 | .458 | 3.18 | 5.50 | .681 | .963 | 26.90 | .618 |
| 1933 | .434 | 3.11 | 5.50 | .662 | .864 | 25.10 | .601 |
| 1934 | .487 | 3.14 | 5.67 | .486 | .751 | 22.49 | .483 |
| 1935 | .492 | 3.30 | 5.69 | .415 | .684 | 21.44 | .444 |
| 1936 | .476 | 1.85 | 5 50 | .464 | .708 | 22.94 | .505 |
| 1937 | .510 | 1.85 | 5.50 | .508 | .757 | 24.70 | .556 |
| 1938 | .492 | 1.85 | 5.50 | .523 | .774 | 15.17 | .572 |
| 1939 | .478 | 1.90 | 5.50 | .521 | .751 | 24.52 | .570 |
| 1940 | .516 | 1.90 | 5.50 | .517 | .730 | 24.75 | .573 |
| 1941 | .547 | 1.94 | 5.64 | .522 | .780 | 25.55 | .367[1] |
| 1942 | .600 | 2.13 | 6.29 | .522 | .810 | 25.74 | .205 |
| 1943 | .631 | 2.00 | 5.93 | .522 | .786 | 25.35 | .195 |
| 1944 | .645 | 2.10 | 6.10 | .522 | .777 | 25.35 | .195 |
| 1945 | .650 | 2.20 | 6.23 | .522 | .777 | 25.35 | .195 |
| 1946 | .671 | 2.41 | 6.50 | .508 | .769 | 24.70 | .190 |
| 1947 | | | | | | | |
| August | .760 | 3.08 | 6.60 | .353 | .629 | 13.63 | .188 |
| September | .760 | 3.42 | 6.60 | .353 | .629 | 13.63 | .188 |
| October | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| November | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| December | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| 1948 | | | | | | | |
| January | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| February | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| March | .760 | 3.42 | 6.60 | .375 | .669 | 14.50 | .200 |
| April | .760 | 4.11 | 6.60 | .375 | .669 | 14.50 | .200 |
| May | .760 | 4.61 | 6.60 | .375 | .669 | 14.50 | .200 |
| June | .760 | 4.61 | 6.60 | .330[1] | .634[1] | 12.76[1] | .176 |
| July | .770 | 4.61 | 6.60 | .353 | .676 | 13.63 | .188 |

### Index Numbers (1910-14 = 100)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1924 | 94 | 64 | 135 | 82 | 90 | 98 | 72 |
| 1925 | 110 | 68 | 126 | 82 | 90 | 98 | 74 |
| 1926 | 112 | 88 | 114 | 83 | 90 | 98 | 82 |
| 1927 | 100 | 86 | 113 | 90 | 97 | 106 | 89 |
| 1928 | 108 | 86 | 113 | 94 | 100 | 109 | 92 |
| 1929 | 114 | 88 | 113 | 94 | 101 | 110 | 93 |
| 1930 | 101 | 88 | 113 | 95 | 102 | 111 | 94 |
| 1931 | 90 | 88 | 113 | 95 | 102 | 111 | 94 |
| 1932 | 85 | 88 | 113 | 95 | 101 | 111 | 94 |
| 1933 | 81 | 86 | 113 | 93 | 91 | 104 | 91 |
| 1934 | 91 | 87 | 110 | 68 | 79 | 93 | 74 |
| 1935 | 92 | 91 | 117 | 58 | 72 | 89 | 68 |
| 1936 | 89 | 51 | 113 | 65 | 74 | 95 | 77 |
| 1937 | 95 | 51 | 113 | 71 | 79 | 102 | 85 |
| 1938 | 92 | 51 | 113 | 73 | 81 | 104 | 87 |
| 1939 | 89 | 53 | 113 | 73 | 79 | 101 | 87 |
| 1940 | 96 | 53 | 113 | 72 | 77 | 102 | 87 |
| 1941 | 102 | 54 | 110 | 73 | 82 | 106 | 87 |
| 1942 | 112 | 59 | 129 | 73 | 85 | 106 | 84 |
| 1943 | 117 | 55 | 121 | 73 | 82 | 105 | 83 |
| 1944 | 120 | 58 | 125 | 73 | 82 | 105 | 83 |
| 1945 | 121 | 61 | 128 | 73 | 82 | 105 | 83 |
| 1946 | 125 | 67 | 133 | 71 | 81 | 102 | 82 |
| 1947 | | | | | | | |
| August | 142 | 85 | 135 | 65 | 66 | 56 | 82 |
| September | 142 | 95 | 135 | 65 | 66 | 56 | 82 |
| October | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| November | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| December | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| 1948 | | | | | | | |
| January | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| February | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| March | 142 | 95 | 135 | 68 | 70 | 60 | 83 |
| April | 142 | 114 | 135 | 68 | 70 | 60 | 83 |
| May | 142 | 128 | 135 | 68 | 70 | 60 | 83 |
| June | 142 | 128 | 135 | 62 | 67 | 53 | 80 |
| July | 144 | 128 | 135 | 65 | 71 | 56 | 82 |

## Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

| | Farm prices* | Prices paid by farmers for commodities bought* | Wholesale prices of all commodities† | Fertilizer material‡ | Chemical ammoniates | Organic ammoniates | Superphosphate | Potash** |
|---|---|---|---|---|---|---|---|---|
| 1924..... | 143 | 152 | 143 | 103 | 97 | 125 | 94 | 79 |
| 1925..... | 156 | 156 | 151 | 112 | 100 | 131 | 109 | 80 |
| 1926..... | 146 | 155 | 146 | 119 | 94 | 135 | 112 | 86 |
| 1927..... | 142 | 153 | 139 | 116 | 89 | 150 | 100 | 94 |
| 1928..... | 151 | 155 | 141 | 121 | 87 | 177 | 108 | 97 |
| 1929..... | 149 | 154 | 139 | 114 | 79 | 146 | 114 | 97 |
| 1930..... | 128 | 146 | 126 | 105 | 72 | 131 | 101 | 99 |
| 1931..... | 90 | 126 | 107 | 83 | 62 | 83 | 90 | 99 |
| 1932..... | 68 | 108 | 95 | 71 | 46 | 48 | 85 | 99 |
| 1933..... | 72 | 108 | 96 | 70 | 45 | 71 | 81 | 95 |
| 1934..... | 90 | 122 | 109 | 72 | 47 | 90 | 91 | 72 |
| 1935..... | 109 | 125 | 117 | 70 | 45 | 97 | 92 | 63 |
| 1936..... | 114 | 124 | 118 | 73 | 47 | 107 | 89 | 69 |
| 1937..... | 122 | 131 | 126 | 81 | 50 | 129 | 95 | 75 |
| 1938..... | 97 | 123 | 115 | 78 | 52 | 101 | 92 | 77 |
| 1939..... | 95 | 121 | 112 | 79 | 51 | 119 | 89 | 77 |
| 1940..... | 100 | 122 | 115 | 80 | 52 | 114 | 96 | 77 |
| 1941..... | 124 | 131 | 127 | 86 | 56 | 130 | 102 | 77 |
| 1942..... | 159 | 152 | 144 | 93 | 57 | 161 | 112 | 77 |
| 1943..... | 192 | 167 | 151 | 94 | 57 | 160 | 117 | 77 |
| 1944..... | 195 | 176 | 152 | 96 | 57 | 174 | 120 | 76 |
| 1945..... | 202 | 180 | 154 | 97 | 57 | 175 | 121 | 76 |
| 1946..... | 233 | 203 | 177 | 107 | 62 | 240 | 125 | 75 |
| 1947 | | | | | | | | |
| August.... | 276 | 249 | 223 | 130 | 75 | 364 | 142 | 67 |
| September. | 286 | 253 | 230 | 133 | 79 | 372 | 142 | 67 |
| October... | 289 | 254 | 230 | 136 | 80 | 387 | 142 | 71 |
| November. | 287 | 257 | 231 | 135 | 80 | 380 | 142 | 71 |
| December.. | 301 | 262 | 236 | 138 | 81 | 400 | 142 | 71 |
| 1948 | | | | | | | | |
| January... | 307 | 266 | 242 | 139 | 83 | 403 | 142 | 71 |
| February.. | 279 | 263 | 233 | 139 | 85 | 393 | 142 | 71 |
| March..... | 283 | 262 | 233 | 137 | 85 | 379 | 142 | 71 |
| April..... | 291 | 264 | 238 | 137 | 85 | 380 | 142 | 71 |
| May..... | 289 | 265 | 239 | 137 | 85 | 370 | 142 | 71 |
| June..... | 295 | 266 | 241 | 128 | 85 | 309 | 142 | 65 |
| July..... | 301 | 266 | 247 | 131 | 88 | 317 | 144 | 68 |

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

**[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.**

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit $K_2O$ thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

# REVIEWS

**This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.**

## Fertilizers

*"Tenth Annual Report of the Arizona Fertilizer Control Office, Year Ending Dec. 31, 1947," Agr. Exp. Sta., Univ. of Arizona, Tucson, Ariz., Spec. Bul., Feb. 1948.*

*"Fertilizing Materials, 1947," Bu. of Chem., State Dept. of Agr., Sacramento 14, Calif., Spec. Publ. 227, March 1948.*

*"Annual Report for the Calendar Year 1947," Bu. of Chem., State Dept. of Agr., Sacramento 14, Calif., Vol. XXXVI, No. 4, Oct., Nov., Dec., 1947, A. B. Lemmon.*

*"Commercial Fertilizers—Report for 1947," Agr. Exp. Sta., New Haven, Conn., Bul. 516, Dec. 1947, H. J. Fisher.*

*"Corrected Tonnage Report Covering Shipments of Fertilizers Sold in Georgia from January 1, 1947, through December 31, 1947, as Reported by the Various Manufacturers," State Dept. of Agr., Atlanta, Ga., March 9, 1948.*

*"Fertilizer Recommendations for 1948," State Dept. of Horticulture, Des Moines, Iowa, Distr. at Fert. Conf. Jan. 6, 1948.*

*"Tonnage of Fertilizer Reported Sold in Iowa—1947," Dept. of Agron., Iowa State College, Ames, Iowa, Distr. at Fert. Conf. Jan. 6, 1948, W. H. Pierre.*

*"Injury to Tobacco Seedlings from Excessive Fertilizer Applications," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 513, Jan. 1948, C. E. Bortner, M. E. Weeks, and P. E. Karraker.*

*"Fertility Management in Maine Orchards," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Bul. 381, May 1948, M. F. Trevett and C. W. Hitz.*

*"Fertilizer Inspection and Analysis; Spring 1947," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 513, March 1948, E. A. Trowbridge.*

*"Agricultural Value of Sewage Sludge," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 733, Sept. 1947, F. E. Bear and A. L. Prince.*

*"County Fertilizer Data: Mixed Goods and Materials—July 1, 1947, through December 31, 1947," Office of The State Chemist, College Station, Texas.*

*"Fertilizer Requirements for Rice on the Soils of the Gulf Coast Prairie of Texas," Agr. Exp. Sta., Texas A & M College, College Station, Texas, P. R. 1104, Jan. 16, 1948, E. H. Templin, R. H. Wyche, E. B. Reynolds, W. R. Cowley, and R. L. Cheaney.*

## Soils

*"Soils of Colusa County, California," Agr. Exp. Sta., Univ. of Calif., Berkeley 4, Calif., June 1948, F. F. Harradine.*

*"Effects of Cropping Systems on Yields and the Nitrogen and Organic Carbon in the Soil," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Bul. 257, May 1948, K. T. Holley, S. V. Stacy, R. P. Bledsoe, T. S. Boggess, Jr., and W. L. Brown.*

*"Soil Experiment Field, General Summary of Results,"—"Dixon, 1910-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Joliet, 1914-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Clayton, 1911-1947," F. C. Bauer, A. L. Lang, W. J. Armon; "Aledo, 1910-1947," F. C. Bauer, A. L. Lang, W. J. Armon; "Carthage, 1911-1947," F. C. Bauer, A. L. Lang, W. J. Armon; "Carlinville, 1910-1947," F. C. Bauer, L. B. Miller; "Kewanee, 1915-1947," F. C. Bauer, A. L. Lang, W. J. Armon; "Oquawka, 1915-1947," F. C. Bauer, A. L. Lang, W. J. Armon; "McNabb, 1907-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Mt. Morris, 1910-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Minonk, 1910-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Hartsburg, 1911-1947," F. C. Bauer, A. L. Lang, L. B. Miller; "Brownstown, 1940-1947," F. C. Bauer, P. E. Johnson; "Newton, 1912-1947," F. C. Bauer, P. E. Johnson; "Enfield, 1912-1947," F. C. Bauer, C. J. Badger; "West Salem, 1912-1947," F. C. Bauer, P. E. Johnson; "Ewing, 1910-1947," F. C. Bauer, C. J. Badger; "Dixon Springs, 1937-1947," F. C. Bauer, C. J. Badger; "Raleigh, 1910-1947," F. C. Bauer, C. J. Badger; "Lebanon, 1910-1946," F. C. Bauer, P. E. Johnson; "Oblong, 1912-1947," F. C. Bauer, P. E. Johnson; "Sparta, 1916-1947," F. C. Bauer, C. J. Badger; "Elizabethtown, 1918-1947," F. C. Bauer, C. J. Badger; "Toledo, 1913-1947," F. C. Bauer, P. E. Johnson; "Bloomington, 1902-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Antioch, 1902-1947," F. C. Bauer, A. L. Lang, D. A. Vinson; "Urbana, 1888-*

*1947," F. C. Bauer, A. L. Lang, C. H. Farnham; Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., 1948.*

*"Better Soils for Better Living," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Bul. 256, April 1948, P. M. Burson, R. S. Harris, and C. O. Rost.*

*"Effect of Water-Retaining and Water-Spreading Structures in Revegetating Semi-desert Range Land," Agr. Exp. Sta., N. M. College of A & M, State College, N. M., Bul. 341, Nov. 1947, K. A. Valentine.*

*"Sod Field Waterways," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 303, Sept. 1947, J. F. Doggett.*

*"Soil Erosion Experiments at State College, Pennsylvania," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 497, May 1948, N. F. Farris.*

*"Revegetation of Sandblows in Vermont," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 542, May 1948, J. B. Kelly, A. R. Midgley, and K. E. Varney.*

*"The Soil Saving 7 for Conservation with Irrigation," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 123, May 1948, M. D. Butler.*

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*"Agricultural Conservation Program—Statistical Summary, 1946," Agr. Conserv. Programs Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., Jan. 1948.*

*"Soil Survey, Lancaster County, Nebraska," Bu. of Plant Ind., Soils, and Agr. Engineering, Agr. Research Admin., U.S.D.A., Washington, D. C., Series 1938, No. 15, May 1948, T. E. Beesley, W. J. Moran, M. M. Kuper, W. S. Gillam, T. K. Popov, B. Bulatkin, and W. C. Bourne.*

*"Soil Survey, The Umatilla Area, Oregon," Bu. of Plant Ind., Soils, and Agr. Engineering, Agr. Research Admin., U.S.D.A., Washington, D. C., Series 1937, No. 21, March 1948, W. G. Harper, F. O. Youngs, T. W. Glassey, E. F. Torgerson, and R. D. Lewis.*

*"Soil Survey, Claiborne County, Tennessee," Bu. of Plant Ind., Soils, and Agr. Engineering, Agr. Research Admin., U.S.D.A., Washington, D. C., Series 1939, No. 5, May 1948.*

*"Effect of Gypsum, Organic Matter, and Drying on Infiltration of a Sodium Water into a Fine Sandy Loam," U.S.D.A., Washington, D. C., Tech. Bul. 937, Jan. 1948, R. F. Reitemeier, J. E. Christiansen, R. E. Moore, and W. W. Aldrich.*

## Crops

*"Fifty-eighth Annual Report for the Year Ending June 30, 1947," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz.*

*"Upland Cotton Production in Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 214, March 1948, W. I. Thomas.*

*"Increasing Corn Yields in Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 473, Feb. 1948, R. P. Bartholomew.*

*"Fish from Your Pond," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaflet 85.*

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*"Growing Snap Beans," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaflet 89, April 1947, E. J. Allen.*

*"Watermelon Production in Arkansas," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaflet 90, April 1947, E. J. Allen.*

*"Twenty-eighth Annual Report—Period Ending December 31, 1947," State Dept. of Agr., Sacramento, Calif., Vol. XXXVI, No. 4, Oct., Nov., Dec., 1947.*

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*"The Cultivated Persimmon in Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 124, Jan. 1945 (Rev. June 1948), A. F. Camp and H. H. Mowry.*

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*"Pecan Production in Louisiana," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Ext. Cir. 269, Oct. 1947, J. A. Cox, R. S. Woodward, and A. O. Alben.*

*"Grow Strawberries," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Ext. Cir. 268, Oct. 1947, J. A. Cox, and W. E. Wilson, Jr.*

*"The Maine Agricultural Experiment Station, Orono, Report of Progress for Year Ending June 30, 1947," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 449, June 1947.*

*"Potato Growing," Ext. Serv., Univ. of*

*Mass., Amherst, Mass., Leaflet 20, Rev. April 1948, R. W. Donaldson, A. I. Bourne, and O. C. Boyd.*

*"Fifty-fourth Annual Report," Agr. Exp. Sta., Univ. of Minn., Univ. Farm., St. Paul, Minn.*

*"Farm Forestry in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 432, June 1946.*

*"Missouri Farmers Move to Peacetime Production, Annual Report, 1946," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 541, April 1947.*

*"Producing High Corn Yields," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Ext. Cir. 114 (Rev.), Dec. 1947, C. O. Gardner.*

*"New Jersey Hybrid Corn Performance Tests, 1940-1946," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 735, Dec. 1947, J. C. Anderson, C. S. Garrison, and J. E. Baylor.*

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*"Growing Spring Oats in New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 737, March 1948, R. S. Snell, C. S. Garrison, and G. H. Ahlgren.*

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*"Planting and Care of Fruit Trees in the Home Garden," Ext. Serv., Rutgers Univ., New Brunswick, N. J., Ext. Bul. 248, March 1948, E. G. Christ and A. J. Farley.*

*"Seeding Tables for Field Crops in New Jersey," Ext. Serv., Rutgers Univ., New Brunswick, N. J., Leaflet 2, Sept. 1947, C. S. Garrison.*

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*"The Place of Crested Wheatgrass on Wheat Farms," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 448, Nov. 1947, H. L. Thomas and D. C. Mumford.*

*"Small Grain Variety Tests, Pennsylvania, 1941-47," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 501, June 1948, J. B. Washko.*

*"Pennsylvania Farmers Serve Current Needs," Agr. Ext. Serv., Pa. State College, State College, Pa., Annual Report, 1947.*

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*"1947 Corn Performance Tests—South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Cir. 71, March 1948, D. B. Shank.*

*"Grow More Corn on Fewer Acres," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Leaflet 93 (Rev.), March 1948, H. W. Wellhausen and B. W. Hatcher.*

*"Summary of the 1947 Corn Performance Tests," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1102, Dec. 17, 1947.*

*"Alfalfa Improves the Soil and Increases Cash Income in the Wichita Irrigated Valley," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1112, March 16, 1948, L. E. Brooks.*

*"An Approach to Year-round Grazing in the Texas Blacklands," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1114, March 25, 1948, H. O. Hill and J. R. Johnston.*

*"Growing Strawberries in Vermont," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Pamph. 15, May 1948, C. H. Blasberg.*

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*"Make Your Garden Grow," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Gardening No. 2, April 1948.*

*"Wisconsin Corn Hybrids," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 476, Feb. 1948, N. P. Neal and A. M. Strommen.*

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*Cir. 107, Sept. 1945 (Rev. Dec. 1947), J. G. Moore.*

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## Growing Alfalfa in North Carolina

(*From page* 8)

they graze one or two cuttings at times when pasture is short and harvest the other cuttings for hay. Alfalfa must be allowed to fully recover after each grazing or cutting, otherwise the life of the stand will be reduced.

Cut alfalfa for hay at the 1/10 to 1/4 bloom stage or when the new shoots appear. Earlier cutting results in lower yields and may weaken the stand. Later cutting results in loss of leaves and lower feeding value.

The objective in curing alfalfa is to preserve the green color and retain all the leaves possible. Windrow it as soon as the swath is wilted. If it is to be stored loose, it can be put up as soon as no moisture can be observed after twisting a handful. It should be somewhat drier for baling. The barn hay drier works very well with alfalfa and makes it possible to get it out of the field much earlier. However, the more water that is evaporated in the field, the less has to be removed in the mow.

Patching up thinning stands of alfalfa by applying more seed seldom succeeds. Instead seed six to eight pounds of orchard grass after the last cutting in the fall. This will lengthen the life of the stand and help keep down weeds.

Under North Carolina conditions, alfalfa usually produces three to five cuttings a year. If it is to live over winter and come back vigorously in the spring, it must be allowed to store up food for this purpose. Consequently, always leave 10 to 12 inches growth in the fall. This, plus the annual top-dressing (400 to 600 pounds of 0-9-27 and borax), should keep the stand healthy and productive for several years.

## Soil Management . . . Tobacco Farmers

(*From page* 24)

if the manure is protected during decomposition, for when it was exposed to the elements for a period of seven to eight weeks, the partly rotted manure plowed under ranked seventh, and as a surface dressing, it ranked tenth, next to a no manure treatment. Despite the high rank of a mixture of horse and stockyard manure, horse manure alone ranked sixth and the tobacco produced showed evidence of some nitrogen deficiency.

A fall application of stockyard manure plowed under at that time ranked eighth while dairy cow manure ranked ninth in average yield. Also, in this comparison, one group of plots received an application of 20 tons of stockyard manure per acre and no fertilizer. This treatment occupied the relatively high position of fifth in the series. In all our tests, an increase in the level of manuring has established an entirely new system of moisture control and nutrient availability, overshadowing the effect of other treatments.

In 1945, the test was revised somewhat with a few of the treatments eliminated and poultry manure and sheep manure added at reduced rates. When the rate of application of manure alone was dropped from 20 tons per acre to the rate of 15 tons per acre, the yield dropped into a virtual tie for last place with the plots receiving fertilizer alone and far below the average of plots receiving both manure and fertilizer. Poultry manure applied at the rate of 7½ tons per acre about a month before the soil was plowed in the spring, immediately was at the top of the yield table with figures approaching a ton of tobacco per acre. However, due to its high nitrogen content the tobacco was dark and oily and the quality was considered lower than tobacco grown with stable manure. It was apparent that the poultry manure must be used only at a very low rate if applied for tobacco, almost below the practical limit of application with a manure spreader. Several instances have been noted of adverse effects of continued and heavy use of poultry manure in connection with tobacco growing. In one case, the manure from 1,000 layers had been used to fertilize a two-acre field for several years in succession and tobacco was grown continuously. Late in August, the crop was only about eight inches tall while in contrast, a small corner of the field which had been in a peach orchard until the year preceding had an excellent growth of tobacco. Soil tests indicated an extremely high salt concentration for all constituents tested in the portion of the field where the crop was poor, whereas in the good part of the field, the concentrations were adequate but far from abnormal.

Sheep manure at 10 tons per acre was found to be a very good source as it ranked fourth in the new series, following surface application of stockyard manure and the sewage sludge treatment, which continued to maintain their second and third positions. The other treatments showed little change in relative position in yield indicating that the previous tests had established their relative value.

The association of high potash content with high quality and resistance to leafspot diseases has been established in the areas in which tobacco is grown on sandy soils, notably Connecticut and Maryland. Under those conditions, an application of 200 pounds of potash ($K_2O$) per acre has resulted in leaf contents of five to six per cent. Recent studies [1] on Hagerstown silt loam at Lancaster indicate a similar relationship at markedly higher levels of potash supply as shown in Table 1.

In every instance, yield was regularly increased by band application and supplemental potash. Half of the extra potash was broadcast before plowing and half applied broadcast after plow-

[1] Report of the Chief of the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, 1947, p. 45.

TABLE I.—POTASH INTAKE OF SEEDLEAF TOBACCO ON HEAVY SOILS IN 1946
ANALYSES ON TENTH LEAF

| Fertilizer at Planting | | Supplemental | | Yield | Per cent | Per cent | Duration |
|---|---|---|---|---|---|---|---|
| 1000Lbs./A | 6-9-12 | Fertilizer | | Lbs./A | Wrappers | Potash ($K_2O$) | of Burn in Seconds |
| K-Source | Method | Source | Lbs./A | | | | |
| Sulphate | Broadcast | None | | 1,582 | 62 | 4.10 | 9.2 |
| Sulphate | Bands | None | | 1,800 | 74 | 5.08 | 9.6 |
| Sulphate | Bands | Sulphate | 380 | 1,933 | 74 | 6.20 | 9.2 |
| Sulphate | Bands | Sulphate | 880 | 2,012 | 69 | 6.02 | 7.0 |

ing and disced into the soil. The grading was better with the band treatment, and bands plus 380-pound supplement (500 pounds $K_2O$ per acre total), than with the broadcast or 1,000-pound total treatment. The potash content on leaves of the tenth position, counting from the bottom of the stalk, also reached its peak with the 500-pound per acre rate. The fire-holding capacity, based on a duration of 10 seconds as perfect burn, was the highest with the band treatment without supplement. As this tobacco was grown in a wet year, the burn was generally good, but a marked diminution occurred with the highest potash rate. This was probably due to the great amount of sulphur, computed as 860 pounds per acre of the oxide ($SO_3$) or 344 pounds of sulphur (S).

The broader aspects of the problem of tobacco culture in Pennsylvania indicate the need for the maintenance of a high level of nutrients and organic matter. This can be achieved by the use of a sod crop in the four-year rotation of tobacco, wheat, hay, and corn, with proper mineral fertilization of all the crops. The use of manures to improve the physical condition of the soil is necessary, but their use may be distributed among the crops rather than concentrated on the tobacco crop. A variety of sources of barnyard manures have been tested and found acceptable. Poultry manures must be used with considerable care as to amount and time of application. Improved methods of fertilizer placement and supplemental applications have proven effective in raising the potash content of the crop to an adequate level.

## Soil Conservation Raises . . . Crop Potentials

(*From page* 26)

crops without danger of erosion than if rotations are relied on to control erosion. Small grain acreage could be increased by 0.6 million acres over what it would be if rotations alone were depended upon to control erosion. At the same time meadow could be decreased by 6.2 million acres.

Increasing soil productivity by applications of limestone, fertilizer, and manures and plowing under green manure or cover crops is an important conservation practice. The degree of soil fertility that can be maintained greatly influences the type of rotation and also the supporting erosion control practices that are needed.

In many localities the application of lime and fertilizer is necessary before profitable legume and grass crops can be grown in the rotation. The farmer who increases production per acre on the more nearly level land can use the more sloping land, where erosion is most dangerous, for permanent pasture or other erosion-resisting crops.

Nearly 119 million acres now in farms in the Upper Mississippi Region must be limed if they are to grow legumes. About one-fourth of the land that is suitable for crops already has been limed once. With an average requirement of from 2½ to 3 tons of limestone per acre, about 250 million tons of limestone or its equivalent are needed to correct soil acidity on the remaining cropland.

Walter's report indicates that at least an additional 16 million tons of limestone are needed each year to replace losses now taking place because of erosion, leaching, or removal by plants. In five of the eight states, the annual loss of calcium from the farm soils during the war was greater than the rate of application.

Prior to the war, farmers in the eight Upper Mississippi Valley states were applying fertilizer containing 189,000 tons of plant nutrients. During the war this increased to the equivalent of 401,000 tons of plant nutrients. To re-

store and maintain fertility through the post-war years the study indicates that farmers need to apply at least 1,711,000 tons of plant nutrients in fertilizers—an increase of nine times over pre-war application. Accompanying this fertilizer would be the application of 4,770,000 tons of plant nutrients in manure.

Corn Belt state production adjustment committees (PMA) suggest the use of fertilizer on about 50 per cent of the cropland compared with 19 per cent so treated in 1943. These committees also estimated that about 41 per cent of the pastures in the Corn Belt need fertilizer; an estimated 1.7 per cent were so treated in 1943.

Cultivated crops remove an average of about 8 pounds of phosphate per acre each year and pasture crops remove about 2 pounds. Almost equal quantities are lost annually as a result of erosion and leaching. Crops take about 21 pounds of potash per acre each year and pastures use 9 pounds. Erosion and leaching cause losses estimated at about three times this figure. Many soils have reached the point where fertilizer is now necessary if any crops are to be raised profitably.

Although it is difficult to determine how much of the increased production claimed by farmers following a good conservation program is a result of the individual practices, it is known that they all play their part. Some of the increased production comes from keeping the fertile topsoil in place and preventing seeds and fertilizers from being washed away or crops washed out.

Increased yields as a result of using commercial fertilizers on corn and other crops have been demonstrated for many years by farmers and State Experiment Stations in all parts of the Midwest where a lack of moisture is not a limiting factor. Conservation practices which conserve moisture make fertilizer more effective.

Seven years of accurate records kept on farms in Illinois show that corn yields on contoured fields were 12 per cent higher (6.9 bushels increase) than yields from corn grown in the traditional straight rows on the same soil type on the same farms. The same tests indicated that contouring increased soybean yields 13 per cent and oats and wheat yields 16 and 17 per cent respectively.

Use of contouring or other erosion control practices as part of a complete farm conservation plan increases yields for three reasons: (1) Soil erosion is retarded or eliminated; (2) a greater proportion of the cropland can be in grain without danger of erosion; and (3) plant-food elements and soil moisture, which might otherwise be lost through runoff, are held in the soil.

Reports from 7,092 farms in the Upper Mississippi Region indicate that use of fertilizer increased farm yields from 43.1 to 57.4 bushels per acre, or 33.2 per cent. Use of fertilizer on small grain is already a common practice in the eastern and southern parts of the region. Reports from farmers indicate that fertilizer used on oats increased yields by an average of about 12 bushels per acre, or 34 per cent. Studies indicate that normal application of fertilizer resulted in an additional 140 bushels of corn for each ton of fertilizer and an additional 100 bushels of wheat for each ton of fertilizer applied.

Commercial fertilizer applied to roughages brings definite increases in yields. The supply of roughage under a conservation system of farming usually will be quite adequate for the number of livestock that can be handled. For that reason, farmers normally will depend on carry-over effects from fertilizer applied on the small grain crop the previous year. Were fertilizers used on all small grains, the carry-over effect would greatly boost the yield of nearly 30 million acres of hay and rotation pasture. Moderate quantities of fertilizer applied directly to rotation hay and pasture crops in this region will increase yields at least 50 per cent.

Commercial fertilizer on permanent pastures gives even more striking increases. Many farmers report doubled

yields. The extent to which farmers can afford to fertilize permanent pastures depends on whether or not they need the additional feed. However, many pastures need fertilizers so they can provide adequate cover to prevent erosion, regardless of whether the feed is needed or not.

Before the war, farmers in the North Central States produced feed grain crops (1937-41) equivalent in feeding value to 66.1 million tons of corn per year. Under conservation farming, feed grain production might well provide the equivalent of 77.9 million tons of corn, or a 12 per cent increase. Pasture and hay land prior to the war produced roughage equal in feed value to 91.3 million tons of hay. If recommended practices were adopted by all farmers, roughage production might equal the feeding value of 170 million tons of hay. Its quality would be higher than pre-war roughage because of increased amounts of legumes.

Farmers used roughage for about 45 per cent of the livestock ration before the war. To use the feed produced under a complete conservation system of farming in these eight states, they would need to use roughage for about 55 per cent of the livestock ration.

Obviously, this change in available livestock feed will require some changes in type of farming and livestock numbers. Shifts in acreages and practices will be more radical on some individual farms than the average change over the entire region. This will be especially true on farms where erosion is serious or where land has been pushed far beyond its natural capabilities to produce. Conversely, on some farms the change in acreage or total production of various feeds will be much less than average.

Dairy farmers could adjust to the change by shifting from corn silage to either legume-grass silage or hay for roughage. From the standpoint of actual income they probably would find it more profitable to feed a higher proportion of hay in the livestock ration.

Increasing beef production rather than hogs offers one of the best solutions for the use of more roughage. In the pre-war years, hogs obtained 88 per cent of their feed units from grains and about 1 per cent from roughage. Beef cattle, however, consumed rations including about 30 per cent grain and 63 per cent roughage. While cattle required nearly one and one-half times as many feed units as hogs per pound of meat produced, they used the feed more nearly in the proportions that farmers would have it under a conservation system of farming. In this connection many individual farmers are beginning to use a much larger amount of roughage especially alfalfa-brome grass pasture, in pork production.

With the increased pasture and hay that would be available, the Corn Belt and Lake States probably would increase livestock production about 40 per cent to utilize the available roughage. Complete use of all the roughage could mean a 20 to 25 per cent increase in dairy production and more than doubling of beef production. Hog production probably would return to about 1937-1941 levels.

Assuming that farmers will produce 40 per cent more meat in the North Central States than before the war and that most of the increase will be in the form of beef, they would need 140 million bushels less corn, 800,000 tons less small grain, and about 24 million tons more hay or its equivalent in pasture than they would use to produce the same total amount of meat if beef and pork production were increased by equal percentages. This fact, reduced to similar words, means that increasing beef production requires less grain than increasing pork production an equal amount.

In addition to these increases in livestock production the states would still raise considerably more feed grains, especially corn, than they would require for feeding on the farm. This means that farmers would continue to ship out grain.

Mr. Walter explained that changes in production in other regions undoubt-

edly would affect the changes in the Upper Mississippi Region. For example, changes in other regions in beef production, dairy production, or any other commodity might influence the change that would occur in these eight states. So a complete and accurate picture of the effect of complete application of soil and water conservation for the United States or any one region cannot be obtained until similar studies are completed for all major areas.

Mr. Walter declared that it is desirable for the United States to know the possible production of its agricultural resources when properly used and conserved for continued production. Thus, we will know what can be produced in physical terms, the extent to which we can increase our yields of food and fiber to meet the needs of an increasing population, or the extent to which we can be self-sufficient in times of national emergency. Equally important is knowing how much food and fiber the United States can contribute to deficit areas of the world without destruction of its own soil resources and consequent danger to the future strength of the nation.

Land is only one factor of production. Agricultural output depends largely upon the degree to which labor, equipment, and materials are combined with land. But the land and water resources must be preserved if the production of food and fiber is to be maintained.

Agricultural production and soil conservation are closely related because conservation maintains the basic resources on which agriculture depends. Many of the recent improvements in crop production, including conservation measures, the report states, are of a permanent nature and will not be abandoned if markets shrink.

If agricultural surpluses should appear, farmers will not find a solution in reducing soil conservation. Adjustment of production to reduced market demand for certain items might mean using the highly productive lands less intensively or it might call for developing new outlets for agricultural products. This does not conflict with the idea that conservation farm plans should permit the production of the commodities demanded in the markets. A change in market outlet due to a shift in demand will call for a change in conservation plans to meet the new situation. The type of farm conservation plan which farmers are developing with the help of Soil Conservation Service technicians, obtained through their locally organized soil conservation districts, is flexible enough to permit these adjustments when needed.

The changes made on each farm will depend on the physical factors (soil type, slope, and degree of erosion), the type of farming the individual prefers, and the relative prices for crops and livestock he can produce. Every farmer has a choice of alternative methods providing equally effective conservation systems of farming, any one of which is designed to control erosion and maintain the productivity on his farm. Therefore, the farmer can choose the type of conservation farming that will conserve his soil, increase his farm's production to the maximum extent, and return the most profit at the same time he protects his soil and water resources for continued use.

## Soil Analysis—Western Soils

(*From page* 14)

measure of soil texture, especially the clay content; and since the clay fraction is in greatest part the soil fraction possessing the property of cation exchange, it is an approximate measure of the exchange capacity of the soil. These two latter relations are illustrated in Figures 5, 6, and 7 representing moisture equivalent, base exchange capacity, and clay determinations for a group of

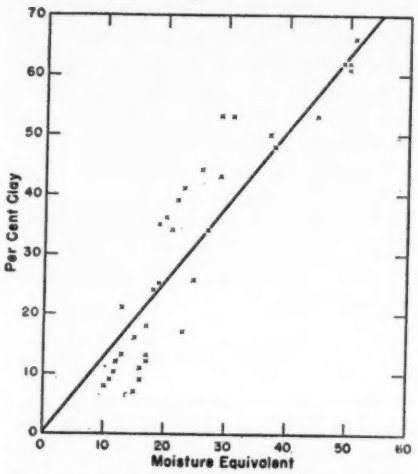


**Fig 6. Showing practical linear relation between moisture equivalent and per cent clay.**

scattered widely throughout the West. The values used to interpret the analyses have been calibrated from field tests with alfalfa and vegetable crops but also are based on experience in the tillage of these soils and other crops grown thereon. The chemical analysis of the soil is not a panacea for all growth problems. It will not show faulty cultivation, poor soil structure, and other physical characters which are closely allied with the productive capacity of the soil. The last 20 years have shown commendable progress in soil analysis and its interpretation, but the need for similar laboratory methods for determining soil structure, rate of water penetration, and other physical characters is imperative for properly examining Western soils.

semi-arid Western soils.

### Summary

The soil tests discussed in this article are those in use at the Arizona Experiment Station. They are believed to give satisfactory indices when used to determine the availability of phosphate, nitrogen, and potash in alkaline - calcareous soils which are

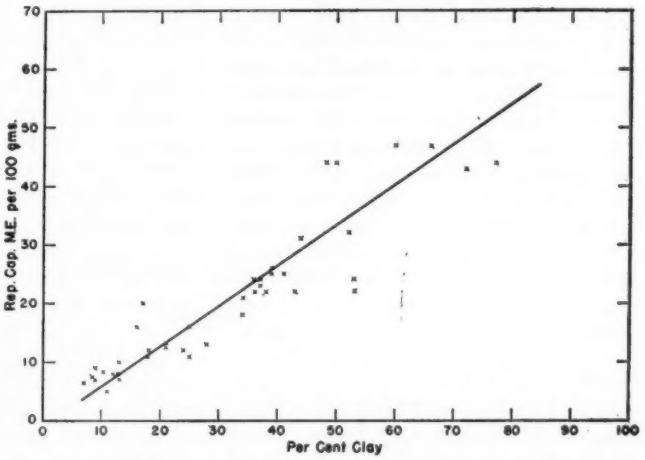


**Fig. 7. Showing practical linear relation between per cent clay and replacement capacity of soil.**

## How Much Lime Should We Use?

(*From page* 20)

roots can penetrate to considerable depths, the oxidation keeps nutrients available in a widely expanded rooting area, and our plants can grow and withstand long periods of dry weather. What is equally as important is that our crops do not drown when we have an inch or more of rainfall during hot weather.

The amount of lime that is needed on a given soil is not always evident. On soils that have been fertilized heavily in the past, particularly where a plow sole exists, the pH of the soil is no indication of the lime content. In our soil-testing laboratory we test many soils that have a pH of 6.4 to 6.8 and yet have a very low reading of calcium.

This is probably brought about by slow diffusion of ions. Such soils when limed may drop in pH. One such soil that I have in mind tested 6.6, and after three tons of dolomitic limestone were applied, the pH a year later was 5.8 but the calcium reading had increased from negative to high with the quick soil test. The crop growth was very much better. People who have not worked with Coastal Plain soils cannot appreciate this happening in a soil.

We have another series of plots in which we went to considerable trouble to lime both subsoil and topsoil. The pH of the check plot is 6.0 while 5 tons of limestone in the subsoil and 5 tons in the topsoil increased the pH to 7.0.

### Overliming?

We established a series of lime plots on a Sassafras sandy loam soil for ornamentals. The pH of the soil was 5.4. Dr. L. L. Danielson from this Station was interested in overliming injury and set up the plots as indicated. The plants growing on the plots include five varieties of azaleas, camellia, rose, gardenia, nandina, lily and gladiolus. Box and several other shrubs are to be planted. The plot treatments are as follows: Plot 1, 100 pounds of sulphur; Plot 2, 50 pounds of sulphur; Plot 3, Check; Plot 4, 4 tons; Plot 5, 8 tons; Plot 6, 16 tons; and Plot 7, 32 tons of dolomitic limestone per acre. Small shrubs were set except gardenia, where rooted cuttings were set. After one year's growth the gardenias in the high-limed plots are 12 to 14 inches tall and well branched. In the 100 pounds sulphur plot they died out. In the check plot they were stunted and showed yellow leaves not unlike many we see growing in private plantings. Any abnormalities that showed up were in plots 1, 2, and 3.

I mention this experiment because it has brought out some things that are not in the "book." In the heavy-lime plots, azaleas are deep rooted. Everyone says that azaleas are shallow rooted and must be mulched. I have always claimed that the depth and extent of the root system of most of our plants is determined by soil conditions, and not by the genetic inheritance of the plant, and when I see shallow rooted plants it is an indication to me that the soil is not suited. Furthermore such soils are not suitable for studying fertilizer problems. When this condition exists our basic problem is soil physics and chemistry and not plants.

### Minor Elements

We are finding more and more minor element deficiencies in our crops. We have found these on soils where rooting is shallow. I feel that to correct the minor element deficiency in such a soil will bring the yield up to a certain level but it still is not a good yield. To get a really good yield the basic problem must be corrected. Therefore, I haven't been able to work myself into a frenzy about our minor element deficiencies and I have little sympathy with overliming data. I have corrected more minor element deficiencies with additional magnesium limestone than I have with additional minor element material except where they occur on high-lime content soils.

Every pound of dry matter that is produced requires a certain amount of nutrient material, and the more yield we harvest the more we need. If we add lime and increase our crop yield to the point where we don't have enough manganese to go around, why do we call this overliming injury instead of manganese deficiency? Why, when we apply high calcium lime to a soil and get magnesium deficiency, do we call it overliming injury instead of magnesium deficiency? If we use too much potash and see calcium deficiency symptoms we don't say "over potash injury." We correct it. If we apply too much superphosphate and get nitrogen deficiency, we don't say "over phosphate injury." We correct the nitrogen deficiency.

From the plant point of view we

are concerned with a balance between nutrient materials. From the soils point of view we are concerned with good tilth or physics. We can't have one without the other and when we are ready to interpret data we should be sure that we have the house in order.

I have spent a lot of Experiment Station time and money trying to find the best method of applying fertilizer and I have had some big differences, but those differences were not brought about by the actual placement of the fertilizer so much as by the change in the condition of the soil. I have come to the conclusion that when the soil is once in good condition it makes little difference where that fertilizer is placed so long as it doesn't injure the roots and it is deep enough so the roots can reach it.

With the above thoughts in mind, properly evaluated, I am convinced that we can take almost any soil and make it productive. There are a lot of submarginal acres that can be made to produce far bigger yields than we now harvest from some of our best land. It may cost more at the present time than the returns from the crop the first year or two, but that should not deter us from finding out how to do this. It is the job of everyone connected with an agricultural experiment to decide what the goal should be 10 or 20 years in the future even though at present we may not find certain practices profitable.

There is one thing that we must do regardless of anything else, and that is to find out how to get the most from an acre of ground regardless of cost, because the time is coming when we will need many times the food that we now produce. Our average yields are a disgrace to the effectiveness of the Agricultural Experiment Station program. We need more coordination within and to get away from the idea of crop people working by themselves in their little cubby holes. We need to do more than follow the leader. We have to get away from the idea of trying to prove that our fellow workers are wrong. We must be open-minded and criticize constructively rather than destructively. Let's try things that are not in the book.

## Pilots for Plowmen

(*From page* 5)

without a careful scrutiny and a plan that fails to meet and conquer criticism does not deserve to live.

FAR be it from me to gloss over mistakes that were made in adopting extension education to the open country. We made plenty. We make them yet and will keep on blundering and feeling along in a somewhat inept way, which is human and not divine. I know some of the county agents who were time-servers and weak sisters back in the days beyond recall. A few of them were moral scalawags and got the quick dismissal. But I whack this typewriter in pride because 99 per cent of the county extension agents and specialists within my field of vision have done far more for others than for themselves. A few of them sacrificed so much time and spent such long hours away from home that they injured their health and left their home folks neglected. None of the "court house crowd" who were wont in former times to be jealous of the county agent would devote as steady attention to detailed duty or make so much of other people's problems. We might make exception here to the county sheriff, but he was usually not as welcome afield as the extension man.

For awhile we had some trouble in my State in adjusting the local professional and businessmen to the new extension program. Nowadays they are its greatest supporters, aside from the

farmers. I have heard veterinarians complain about the services of the agent in bovine midwifery or sick pig cases. The stock buyers disliked any cooperative organization on the agent's part. Recommendations on mineral mixtures of a home-made variety, cheap and effective, often ran counter to some merchant's wares. Yet today the civic clubs that meet every week in the town's hotel for a rousing gabfest usually have the county agent on the executive committee. Petty matters sometimes still bob up, but the air is a lot clearer, believe me.

In any discussion of this nature anent the extension service, it would be folly to omit the contribution made by the active and farsighted farmers themselves. This is no applied system rammed down from above. It derives its juice and substance from the soil and the satisfaction and aid of the tiller and feeder, who see in research and the adoption of it a way out of difficulties.

Had there been no trail blazed by county extension methods for 25 years, the success of the myriad of new agencies enlisted in modern agricultural policies would have been far less effective or lasting. Moreover, the extension system will outlast them all—and this is no more of a criticism than to say that your body outlasts a new suit of clothes.

THE splendid way in which these newer agencies and the county agent system work together is exemplified well in the scores of big soil conservation field days we have witnessed lately. Jobs of staggering physical immensity are done in six or eight hours by huge crews of organized and trained volunteers, with a background of educational value. They get the spotlight of publicity too. Last month several newspapers in Washington, D. C., had special farm editions teeming with facts and figures and news pictures galore, telling the story of a new kind of rural work festival near old historic Harper's Ferry. Maybe the spirit of John Brown rides no more in that locality, but freedom from a worse kind of slavery is assured by soil-conserving terraces and contours. Its object is peace, not prejudice.

I submit that much as the extension service could and does perform alone, it is this alliance of the engineers and soil experts with the farm leaders and committee specialists that brings us a dawn of hope, where small demonstration plots and plowing matches or corn husking contests were once the main attraction. The wise county agent and his sister, the home demonstration lady, welcome such help even if some of the honors have to be divided. There is no place in our structure for disruptive rivalry. American agriculture, the biggest food factory in the world, has need of unity and cooperation in all its enterprises. This goes for the youth movement too, where wrangling among guides and mentors is not becoming or constructive.

Getting the news and advisable methods on farming to the county agent's bailiwick is primarily the spot job of the radio station now. But the farm press is always an eager associate. Farm editors have as a rule endorsed and contributed to the extension service through the teeming years. They have found the county agent willing to ride with them and introduce them to exceptional "success stories." They filled many columns with articles written by extension workers. When some worthy individual in this group quits after many years of duty, he often gets a "hand" in the farm journals. Such a case is to be noted in a page torn from an Indiana farm paper, wherein the 35 years of field effort in behalf of hog breeding and feeding on the part of John Schwab of Purdue University is told with relish. John graduated from Iowa State College in 1913, and he became the very first hog specialist hired under the Smith-Lever Act of 1914. From then on, he devoted his waking hours to "mortgage

lifting" via the pork route to profits. Yet this is not so mundane and common a lot as one might hastily believe. For out of good roast pork well-relished comes sustenance for good endeavor, and from pigs well-fattened on ripe corn and supplements come ways and means for a broader and a fuller farm life. (These are my own sentiments, not those of John or the Guide itself.)

I have always felt that in our way of life there is a good niche reserved in the hall of fame and high regard for folks who do the ordinary tasks a little better, without vainglory or public acclaim. Besides, when such folks are called to final reckoning there won't be much argument about how they stood on imponderables and international vexations, because they stayed home and tended to their knitting so that somebody would have a sock to fill.

This big extension job could not be done alone by the relatively few persons hired at present in an official capacity by the cooperative service. They are just the key people who unlock the door of opportunity which is pushed open by many other hands. I have here a recent summary of the enlistment of extension workers.

THE grand total of county agents, home agents, 4-H leaders and field specialists numbers 11,440. There are 3,107 agricultural counties in the country, and 117 directors and assistant directors at State headquarters. White county agents total 2,967, and their assistants number 1,525. Negro county agents number 351. Home demonstration agents listed total 2,327, assisted by 622 persons. In the colored field there are 369 home agents at work. There is shown a comparison with numbers a year ago. It indicates a gain of 20 county agents and a loss of 10 demonstration agents, made up, however, by a gain of 49 assistant women agents. County agents possess 20 State leaders and home demonstration work claims 43 State leaders.

In the realm of 4-H clubs the present statistics enumerate 58 white and 7 Negro State leaders, a total of 161 assistant State and district leaders, with 516 county leaders and 142 assistant leaders of both races.

EMPLOYMENT of extension subject matter specialists in 1948 footed to 1,876. New York boasts the most of these specialists, or 131. Texas with 243 county agents heads that category, not including the Negro county agents numbering 47. Again in the distaff side of things, Texas tops with 181 white and 45 colored home agents. Away out in the Pacific is the territory of Hawaii, claiming at least nine persons working as county agents and a similar roll call of women agents. Alaska has one county agent and two home agents.

So the march is on. Growth is just rapid enough to be safe and sane. Only the time-tried and acceptable programs last.

In concluding this reverie on extension matters, let me quote some of the concrete objectives of agricultural extension, taken from a piece written by C. B. Smith. It puts into a small frame the creed which appeals to the best and most practical folks who have seen the parade go by for lo, these many years.

"To bring the farmer knowledge and help that will enable him to farm still more efficiently and to increase his income.

"To encourage the farmer to grow his own food, set a good table, and live well.

"To help the members of the farm family to a larger appreciation of the opportunities, the beauties, and the privileges of country living, and to know something about the world in which they live.

"To promote the social, cultural, recreational, the intellectual, and the spiritual life of rural people.

"To place opportunity before rural people whereby they may develop all their native talents through work, recreation, social life, and leadership.

"To build a rural citizenry, proud of its occupation, independent in its thinking, constructive in its outlook; capable, efficient, and self-reliant, with a love of home and country in its heart."

I really think this covers it pretty well and soundly. Even in this day of great technical skill and the high degree of self-reliance coming to electrically equipped homesteads provided with good equipment and facilities for their own comfort, we must have the common touch and the neighborly feeling. We cannot afford to dwell unto ourselves alone.

There is thus left to farm communities the key through extension methods (their own and that of the State-Federal County system) a sure means of retaining elements of the pioneer spirit that made us strong originally. That spirit was teamwork and friendly intercourse, not frigid self-satisfied aloofness. If it is true, as one Midwest farmer just said, that today all we have left in the older farming sections to tie us together is the cooperative marketing unit, then we need something deeper and sounder.

Extension can teach and reach out among farmers for the remedy against smugness. If success coats us over with a sort of insulation from the rest of society by dint of technical self-sufficiency, it's time to get back on the circuit again.

Hence there remains a vestige of rural religion to cultivate that acts as a challenge to modern extension programs, and that religion has no finely drawn creed, but is broad enough and warm enough to sustain us all.

If the extension man is the plowman's pilot, he must not forget that there is some remote connection yet, even in this scientific age, between the *plow and the stars!*

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Old Lady at Poultry Show: "What kind of chickens are those?"

Attendant: "Capons."

Old Lady: "I've heard so much about 'em, will you sell me a setting of their eggs?"

* * *

An outbreak of smallpox in a southern city caused an order to be issued for the immediate vaccination of all citizens who had not been thus immunized within the year. To facilitate the work, each voting precinct had its own vaccination unit and residents were required to report to it as soon as possible.

A negro mammy applied at the wrong place. "Sorry, mammy," said the doctor, "You'll have to be vaccinated in your precinct."

"So das it," said mammy righteously indignant. "De white ladies gets vaccinated in de ahms and de laigs—and we gets it in the precinct."

* * *

Jimmie carried the following excuse to the teacher the next morning: "Please excuse Jimmy from being absent. He had a new baby brother. It was not his fault."

* * *

First Student: "I like mathematics when it isn't over my head."

Second Student: "That's the way I feel about pigeons."

Bride (viewing twin beds): "Ooohh!"

Husband: "What's the matter, dear?"

Bride: "I thought we were going to have a room to ourselves."

* * *

BUGHOUSE FABLE

"Will you please drive off the track?" asked the motorman. The truck driver promptly drove to one side.

"Thank you ever so much," added the motorman, with a smile.

"You're very welcome," responded the truck driver, "but you must pardon me seeming careless. I had no idea your car was so near."

* * *

There are four kinds of women: Fat, Skinny, O.K., and "Get-a-load-of-her!"

* * *

Lady: "How much are those tomatoes?"

Grocer: "Seven cents a pound, ma'am."

Lady: "Did you raise them yourself?"

Grocer: "Yes, they were five cents a pound yesterday."

* * *

Who hasn't heard about the Scotchman who was nearly pummeled to death because he thought the sign on the door said "Laddies?"

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